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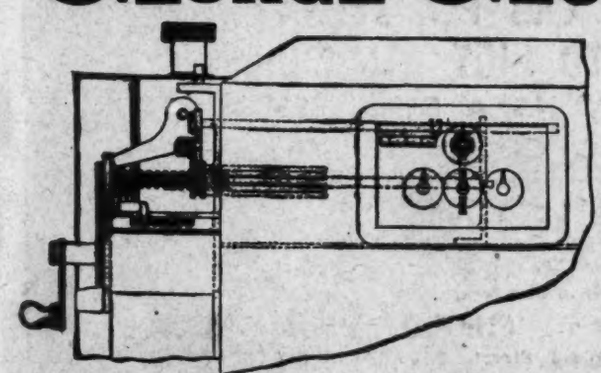

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1917

A Retrospect.

THE war years that have passed since the fateful events of 1914 will for ever stand out conspicuously in the history of the world. But of those years that which is closing has been perhaps the most momentous. The year 1916 ended in a way that bid us then look with good hope upon the *début* of the new one. The hope was soon to be shattered. The world has since been rocked by stern events vital in the war. The revolution in Russia, its capture by anarchy and treachery, the negotiations for an armistice and withdrawing from the war, and for, to all intents and purposes, bringing Russia under the subjection of Germany, have had a gravely retarding influence upon the course of the war. But, *per contra*, America has allied herself with the cause of truth, justice, and freedom, and is equipping herself with energy and enthusiasm for helping to give the death-blow to the ambitions of those Powers who, lusting for world domination, sought to impose it by armed might, scattering death and destruction everywhere. Through being deprived of Russian aid, Roumania, too, is likely to withdraw from the war. King Constantine of Greece is no longer where his intrigues can harm the allied cause. Only the internal disruption of Russia has placed the Central Powers in the position now occupied by them in relation to that unhappy country, and to only the same cause is attributable the dramatic move recently made against Italy, which caused a temporary set-back that our brave Allies have, however, since arrested. Victories have attended the courageous British and French Armies on the Western Front. The Allied Navies, too, have been doing their heavy duty with successful vigilance. But the infamous and inhuman conduct of the war on the part of Germany has continued. Liners have been torpedoed, and the passengers left to the mercy of the waves. Unarmed merchantmen have been sunk; and their crews sent adrift in open boats, and in cases have been fired upon. Iniquity has gone deeper by the sinking of hospital ships and the bombing from the air of hospitals in which wounded men were lying. And the cowardly assassins of the air have continued to murder civilians in their sleep. An attempted justification of the diabolical work is that this is a war of nations. But civilization cannot accept the principle nor the excuse for these outrages on humanity. One effect of them has been to reinforce the will of the Allies to fight on to the end they have in view—the realization of conditions that will assure a permanent peace. But the ways of Prussianism in war will not soon be forgotten in any part of the world; and the German people have to reckon upon the facing of the world again with a deeply crime-stained reputation. However, we have much of which to write in reviewing the immediate affairs of the gas industry, and so must not linger further over the preface.

A MANY-FEATURED COAL HISTORY.

Rising high above all other questions immediately affecting the gas industry during the year has been that of coal supply. Everything associated with it has been erratic; and those responsible for the maintenance of the work of gas undertakings were, in the first part of the year and again towards the latter part, constantly kept in a state of perturbation, both as to the situation and the prospects—the only period of peace and of greater hopes for the better being in the summer months when stocks were accumulating. From beginning to end, bolts have intermittently been shot from all quarters associated with coal; and gas engineers have been living, with the exception of the period mentioned, in a permanent state of unpleasant uncertainty, which has made their responsibilities weigh the heavier. The coal history of the year very largely centres about the control of the coal mines and coal supplies. The labour unrest in the South Wales coalfields was the initial cause of control being brought about. The mines in that everlasting storm centre were taken under the wing of the Government; and the year had barely started its course when the Government decided to take under control the whole of the coalfields. About the middle of February came the appointment of Mr. Guy Calthrop, General Manager of the London and North-Western Railway Company, as Coal Controller, with Sir Richard Redmayne, K.C.B., His Majesty's Chief Inspector of Mines, to assist him. An Advisory Board was also appointed. Hopes were great. The gas industry looked to better deliveries, and to the terms of the Price Limitation Act being complied with. How far there has been realization of these hopes, the experiences of the year have shown. It has been a year of difficulties, disappointments, extraordinary efforts, counter instructions, with short-lived hopefulness and stock accumulations during the summer.

THE FIRST FRUITS OF CONTROL.

The year opened with weather that demanded extraordinary outputs of gas. Coal was not coming in freely, and stocks sank to almost vanishing point—cases being heard of in which, without fresh deliveries, exhaustion could be counted by days and even hours. In March came the first instruction from the Coal Controller. It was to the effect that colliery owners, factors, and merchants should refrain from making contracts for a longer period than three months; and here we had the initial intimation of the view of the Controller that the paramount necessity was to deal with coal in a manner that would give relief to rail transport. More locomotives and rolling stock were going over to France, and a further "combing-out" of labour was pending; so that, bad as transport had been previously, the situation had to be faced that it would be worse, and particularly during the winter through which we are now passing. Never during the whole year has there been actual shortage of coal at the pits for the requirements of the country; the shortage has been all a matter of distribution. Inquiries made by the "JOURNAL" at the time at the offices of the Coal Controller elicited the statement that he fully realized the importance of building-up coal stocks at gasworks during the summer months, and that in any reorganizing scheme their position would be fully borne in mind. But three months' contracts threatened security (including the maintenance of the supply of gas to the community and the provision of high explosives), and the projection of heaviest deliveries from the summer to the winter—a condition that would have been directly opposed to the plans of the Controller. The Chairman of the Executive Committee of the National Gas Council (Mr. D. Milne Watson) then interviewed the Controller; and shortly afterwards came the announcement that, so far as gas undertakings and other public utility companies were concerned, twelvemonth contracts could be made as usual, subject to the insertion of a clause to the effect that contracts might be revoked if the Controller deemed it necessary. It was also mentioned that any contractor declining to make twelvemonth contracts with such undertakings would be dealt with by the Controller. After this, little more was

heard of three months' contracts; there was really nothing in the idea that would assist the Controller.

A more reasonable suggestion was that all descriptions of coal should be purchased as near as possible to the consuming points—thus securing a minimum of haulage, and so economy in the use of wagons and locomotives. Then there was a settling-down to a more hopeful condition of things. District superintendents were appointed to assist the Controller, supplementing the Coal and Coke Supplies Committees; and Mr. Calthrop gathered about him advisers who knew the needs of different industries. Mr. Thomas Glover, of Norwich, was selected for the position in relation to the gas industry; and he has essayed, under a weight of imposing difficulty, to work in the interests both of the Coal Controller's main objective—the economy of rail transport—and of the gas industry. Soon after, too, Mr. E. W. L. Nicol, the Expert of the London Coke Sales Committee, was appointed by the Controller to help him in relation to coke supplies and use. Advice was issued from time to time as to how the public, especially large users of coal, could help the Controller. Accumulation of stocks in summer was one way; the use of coke as far as it could be obtained another way; and the employment of gas and electricity for cooking and heating another way—the last-named, as far as gas is concerned, in view of the fact that at gas-works the coal is put to such economic use that there is advantage to the country, besides which distribution of gas is easier than the local distribution of coal in small quantities. But how the consumption of electricity could help in coal saving, with an average use of 4½ lbs. per unit of electrical energy generated, has never been explained. Then we had from one Government Department a public request that consumers should use less gas and electricity, in order to save coal; while the Ministry of Munitions appealed for more gas to be used in the interests of the production of high explosives. But these were only incidents in a varied tale.

The Uneconomy of Inert Material in Coal.

Again, there was an appeal to gas undertakings to use unscreened in place of screened coal, so as to expedite the dispatch of rolling stock from the collieries. This recommendation was not persisted in by the Government Department concerned. But a greater piece of uneconomy was never suggested; and the result so far as the country is concerned has been enormously wasteful. The percentage of ash and dross sent out from the collieries, and paid for as coal, has increased considerably—16 to 20 p.ct. has been heard of. This has been distributed; its carriage has had to be paid for; and extra coal has had to be bought and carried to compensate for it. It has for gas-works alone meant the handling of the extra inert material above the normal quantity, a corresponding reduction of retort capacity, a poorer quality of coke, more coke required for producers, and a reduced production of residuals—including benzol and toluol—per ton of material dealt with. But despite all protest, despite the immense accruing uneconomy, despite the use of locomotives and wagons engaged in the unprofitable task of carrying this rubbish about the country and ships from port to port [Mr. H. O. Carr gave an indication of what it meant at the recent meeting of the Southern Association], nothing has been done to correct it. To all representations there has been the one reply, that there will be attention to any specific complaints, though the trouble is notoriously general. The cause was attributed to a shortage of labour for picking at the pits (some people say the unions will not permit the employment of women labour for this work); the result is an increase of labour everywhere. The coal owners continued to profit from the sale of the rubbish at the price of good coal. In addition, large consumers have found they have been suffering from short deliveries. Cases have been known in which trucks "weighed out" as much as 5 cwt. and more short of the declared quantity.

Blue Water Gas and Coal Economy.

Soon after the appointment of Mr. Glover, an appeal was made to the gas industry by the Coal Controller to help him by utilizing, wherever possible, blue water gas up to (say) 20 or 25 p.ct.; and this plan has been largely adopted with beneficial results, which point to permanent rather than to temporary use in the general cause of economy. At the same time, it was realized that this use of blue water gas would affect the production of benzol and toluol. Again the advice to the public in effect to transfer their domestic consumption of coal for treatment to gas-works by buying gas instead of coal assisted to maintain the production of the requirements of the Ministry of Munitions. No sooner, however, had gas undertakings got well settled down to the mixing of a proportion of blue water gas with coal gas, than the order came to them to once more change their methods of working, and use as much coal as possible, in order to increase the production of fuel oils. The famous low-temperature carbonization project came in here; but that is another story. The same causes that made the production of increased fuel oils imperative made a great shortage in gas oils; and, as a matter of fact, gas oils became unprocurable, excepting in limited quantities, and at a price that no gas undertaking would pay, if it could possibly avoid it. To blue water gas, steps had to be retraced.

The Coal Redistribution Scheme.

Then came the great coal redistribution scheme, which with much patience and skill the Coal Controller and his advisers framed, with the view to save railway haulage, to which all other considerations in the national interests had to give way. The first definite information as to the character of the scheme was given in July; and it was found to be dressed in much optimism. It was estimated that the scheme to the extent to which it had then been developed would save 700 million ton-miles in the transport of coal by railway. Contracts for sea-borne coal were not affected; but in respect of all others, except those that complied with it, the scheme of redistribution was based upon a plan providing for specified areas obtaining their coal supplies from the coalfields allocated to them. Those concerned, including gas undertakings, determined to loyally help the Coal Controller to make the scheme a success—as a matter of fact, whether or not they so determined, the scheme was compulsory; and all contracts affected by it came to an end on Sept. 8. Between the time of the promulgation of the scheme and that day, the prudent administrators of every concern did their utmost to get in as large stocks as possible. They were fortunate who succeeded; for the subsequent weeks showed that, despite the work of the local Coal and Coke Sales Committees (which then, as now, included a representative appointed by the Controller without association with the coalfields), numerous undertakings had difficulty in getting allocation of new collieries, and in many cases the quantity allocated was considerably short of the amount previously contracted for and required. Many, too, found themselves with supplies of inferior gas-making coal, and at prices over what had been formerly paid. There was great dissatisfaction—more in some areas (Scotland for example) than others. The National Council brought these matters to the attention of the Coal Controller. Mr. Glover, who was fortunate in obtaining the services of Mr. W. M. Mason, the Secretary of the British Commercial Gas Association, to assist him at the office of the Coal Controller, had a busy and anxious time. A number of well-known gas engineers were also appointed to act as inspecting engineers to investigate difficulties, and to assist in straightening them out. There was sufficient coal for the satisfaction of the country before the introduction of the scheme; and the Coal Controller's confidence did not abate in the ability of his plans to reach the goal he had before him. But there had to be readjustments here and modifications there to make the supply fit the requirements of the different areas. Things have mended, but not by any means entirely; and there are many gas engineers who will be thankful when they are able to again purchase the coals they consider most suitable for their purposes, which are not always those that are geographically the nearest available. Succeeding the day when the old contracts were terminated, the stocks that had been accumulating during the summer in view of a difficult winter began, owing to the shortage of new deliveries, to be eaten into, and thus the scheme of redistribution partially defeated its intention of relieving winter coal traffic.

Prices and Complicated Burdens.

Under the redistribution scheme, the question arose as to what would be the base price under the Price of Coal (Limitation) Act; and the Coal Controller decided that contracts entered into by the collieries concerned, on the corresponding day or as near thereto as was practicable during the twelve months ending June 30, 1914, should be the ones

taken. Mr. Calthrop showed the greatest determination to compel both sellers and buyers to comply with the Act. At his instance, the Board of Trade issued an order instructing all colliery owners to only enter into contracts (unless otherwise directed) at the maximum price provided by the Act; the intention of this being to prevent collieries with spare coal through the shortage of shipping competing at lower prices a distance away involving longer railway journeys. This mandatory provision seemed contrary to the intention of the Act. However, at the time of the advent of the redistribution scheme, the Controller made it known that he should deal in no uncertain manner with both sellers and buyers who violated the Act, as he recognized that there had been abuse of its provisions. There followed the cancellation of all contracts so far as prices were concerned, in order to permit their revision to comply with the terms of the Act. Further complexity was occasioned by the rates fixed for coal factors and merchants above the prices provided by the Limitation Act—3d. per ton being allowed for contracts with the railway companies, 6d. for those with munition works, and 9d. for those with gas and electricity works. The big difference against gas undertakings as compared with railway companies was resented; but the Coal Controller, in replying to the representations of the National Gas Council, pointed out that the 9d. was a maximum and not an obligatory charge, and no change could be made. There is little likelihood of the benevolence of factors and merchants being exercised in the direction of charging less than the 9d. But worse immediately followed. In respect of the increase in miners' wages allowed by the Controller in September, 2s. 6d. per ton was added, in the middle of October, to all contract prices, and was made retrospective to Sept. 17, which was unfair in view of the fact that it was impossible to raise the price of gas without due notice to consumers. There is, moreover, no certainty that this is the end of the burden; for in allowing the additional 2s. 6d., the Coal Controller explicitly stated that, when making this addition to the price of coal, increased costs of production other than the war wage had not been taken into account; and, further, that applications made by certain districts for an increase in the standard amount under the Price of Coal (Limitation) Act were being examined by the Controller. The position thus remains nebulous and unsatisfactory. The users of South Wales coal were much aggrieved, seeing that already collieries there had had 2s. 6d. allowed above the standard 4s. fixed by the Act; and this further 2s. 6d. in respect of miners' wages made the total excess above pre-war prices 9s. per ton. The National Gas Council pointed out to the Controller the hardship of this; but he was not prepared to make any modification. On the contrary, he suggested that the Welsh undertakings secured advantage in respect of railway carriage.

The Miners' Increase.

Regarding the miners' increase, the men were already getting fixed wages ranging from 9s. 5d. to round about 11s. per day; most districts being in the neighbourhood of the latter figure. We remember the time when the miners asserted that they would defend their fellow workers in the country from having to pay excessively for coal through profit-making by colliery owners. Their protestations of loyalty to the poor found expression in the application in July of the Miners' Federation for an increase of 25 p.ct. on the then current wages of all men and boys employed in and about the collieries. The result of the negotiations with the Coal Controller was the introduction of a new principle so far as miners' wages are concerned—that was, the application of a flat-rate increase per day of 1s. 6d. to workers over 16 years of age and 9d. to youths below that age, which was calculated by one mining authority to represent an addition of £21,375,000 to the annual wages bill for the miners. From this figure and from the official returns as to coal output for 1916, we calculated that the increase would be equal to 1s. 8d. per ton; and in November the "Iron and Coal Trades Review," on the assumption that output had been reduced to about 250 million tons a year, came to the conclusion that the special war wage was about equal to 1s. 10d. per ton. So that, at any rate, the 2s. 6d. represented some 8d. to 10d. a ton drawn from purchasers' pockets beyond what was necessary. On an annual consumption of about 18 million tons of coal, this extra 2s. 6d. means for the gas industry £2,250,000!

The Mines Control Bill.

Towards the end of the year Parliament was invited to consider a Bill which was to make control the effective thing intended in the first instance. As will have been seen, the Controller had had his hands full and his mind well occupied right from his advent in office. But, even so, he had had to find time to discuss with the Mining Association of Great Britain, as representing the colliery-owning interests, the question of an agreement dealing with the financial side of control which was to form the basis of legislation. When the Bill was drafted and published, there was open rebellion on the part of a large section of colliery owners, who ineffectually sought to repudiate it on the ground that it was inequitable and unjust. Their protest was in vain; and its very utterance a pitiable negation of all those whilom assertions that the 4s. standard excess had not covered their additional war outgoings, just as had been the profits earned and the dividends paid during the period of the war.

Under the agreement and the Bill, pre-war dividends are to be paid; and pre-war dividends in many cases were good in view of the fact that they were made during the period in which demand and prices were influenced by the great coal strike. The payment of the pre-war dividends is contingent on output being maintained, unless proved that there are satisfactory reasons for diminution. However, upon the pre-war rate of dividend the collieries are to be allowed 5 p.ct. of any excess profits that may be made. The excess profits duty in other businesses provides for 80 p.ct. being taken; but the agreement makes it 95 p.ct. in the case of coal—the extra 15 p.ct. being largely taken for utilization in payment of compensation to concerns which may be entitled to it under the agreement so as to bring their profits up to the guaranteed standard. In addition to this, by subsequent arrangement, it was understood that the guarantee was to be made a Treasury obligation—this owing to the anxiety of the dissentient colliery owners that there should be no flaw in the security of a return with which their objections showed they were greatly dissatisfied. The Bill has been before the House of Commons; and it then appeared that the Government intended that the scheme should be self-contained, for there was no Treasury obligation in the Bill. What the so-called Treasury obligation amounts to is that the Board of Trade will, if there should happen to be a deficit, go to the House of Commons, tell them frankly and plainly the position, and ask for it to be dealt with in a proper way. There was much opposition in the House of Commons, on behalf of the dissentient colliery owners, who represent 100 million tons out of the 250 million tons of output. But they did not succeed in altering the agreement—at any rate, in any material manner. It was made quite clear that coke ovens and bye-product plants at collieries were excluded from the operations of the Act. The position of the Bill is that it has passed through the Commons, and is now under way in the House of Lords.

Railway and Sea Transport.

There was, as we have seen, a great deal of talk during the year as to how to economize coal—all with the view of relieving pressure on the railways, and not because there was any real dearth of coal at the pits. That the pressure was considerable during the winter 1916-17 is well known; and then, early in the year, it was intimated that the Government would have to take over another 24,000 trucks. Schemes to pool the railway companies' trucks were finally adjusted; and changes were made with the view of increasing essential traffic. A better utilization of private wagons on return journeys was arranged for; and some trouble arose owing to the diversion of privately owned wagons. Supplementing all these efforts came the coal redistribution scheme. Another slight measure of relief was the larger transport of coal by canal. But withal the pressure on the railways is heavy. What it would have been without the effort that has been made to ameliorate it, cannot possibly be gauged.

During the year gas undertakings obtaining coal by sea—the London and other companies—lost some of their colliers through submarines or mines; and this naturally much affected their position as to costs, which (even for their own vessels) went up considerably per ton. The cost of insurance alone was a very heavy item. Some notable illustrative figures were supplied by Mr. W. G. Bradshaw

at the meeting of the Commercial Gas Company. He stated that additional vessels had had to be purchased to fill up the gaps created by the longer duration voyages under the present running restrictions. In 1914, the cost of freight and shipping charges to the Company was 3s. 11½d. per ton, while in the second half of 1916 it rose to no less than 9s. 5d. per ton, which is an increase of 138 p.ct. Before the war 20s. was paid for freight per ton of oil brought across the Atlantic; in the second half of 1916, the price was 129s.—an increase of 543 p.ct. Very high freights ruled throughout the year; and those undertakings possessing boats of their own were fortunate.

Home Supplies and Exports.

As previously remarked, whatever difficulties were felt in relation to coal deliveries were not due to any shortage in the quantity of coal available at the pits. This is readily seen by the official figures. The total output of coal during 1916 was 256,375,366 tons, against 253,206,081 tons in 1915. Deducting exports and bunkers, the quantity available for home consumption was 200,845,000 tons, against 189,073,000 tons in 1913, in which latter year the record quantity of over 73,400,000 tons was exported (excluding bunker coal). This year the detailed returns as to exports have been stopped; and only general figures are now published by the Board of Trade. During the ten months of the year to October, the exports of coal, coke, and patent fuel were 32,619,757 tons—a reduction of 2,531,415 tons on the corresponding period of 1916, and of 6,210,849 tons on the ten months of 1915. This gives some indication that home supplies have been well maintained, and that transport is responsible for any deficiency where it exists, together with the trouble arising from the introduction of the coal redistribution scheme just at a period of the year when the country was entering upon the time of heaviest consumption.

Oil Supplies.

The increasing prices of oil and the difficulty of obtaining supplies led to a considerable reduction of use for carburetted water gas making in 1916 compared with 1915; and those who continued to use it consumed less per 1000 c.ft. of gas made. This trend of things persisted for the same reasons during the current year. The advocacy of blue water gas by the authorities gave some relief, and at the same time economy. A Special Committee was appointed by the Ministry of Munitions to consider the question of the supply of gas oil for the present winter; but all they could recommend was strict economy, and, wherever possible, the manufacture of blue water gas. Although there was a scarcity of tonnage, owing to the requirements of the Government and other causes, the large oil companies were able to declare magnificent dividends. But it must be said that the increased prices asked per ton or per gallon were attributable more to the cost of freight than to the shortage of supply. This was emphasized at various gas companies' meetings. For gas oil some contracts were announced as having been made in the forepart of the year at from 10½d. to 1s. per gallon; but there were other concerns that were not as fortunate even as this—cases being heard of where 1s. 6d. and even 1s. 8d. per gallon have been paid. A mineral petroleum supplies branch of the Ministry of Munitions was established; and in the middle of the summer an order was issued by the Petroleum Pool Board that the supplies of gas oil to gas undertakings were to be discontinued, unless a certificate of the Ministry of Munitions was held permitting the supply. Information came from America (from which the largest proportion of the world's supplies is secured) that the visible supplies would only last twenty to thirty years, in view of the large and continually increasing use of oil for fuel purposes. The enormous expansion of the motor car industry is one cause of this. Prospecting went on apace; but it was stated that the results in increased output were not on the same scale as formerly. In connection with the Petroleum Executive, Parliament has empowered the carrying out of a scheme of survey and working of petroleum deposits in this country as a matter of national enterprise. A very strong body of experts has the matter in hand; but there are other experts who are looking on with considerable doubts as to the issue.

A Conspiracy of War Conditions.

War conditions have conspired to open the eyes of the gas industry to its opportunities in a way that it probably would have taken many years to have accomplished otherwise. The needs of the country and its Allies for the materials for high explosives and fuel oils initiated developments. The oil-washing of town gas for the extraction of crude benzol, and its constituent toluol, proved the suitability, in respect of calorific power, of gas so treated for town supply, providing the incombustible gases were kept to a minimum. This, as already intimated, led to the consideration of the dilution of a well-made coal gas by blue water gas and by steaming in vertical retorts, by which results have been obtained which show that economy is resident in these proposals. Further, it is seen that a higher carbonizing efficiency than formerly is possible with steaming, with good effects upon the quantity of secondary liquid products—the result being that a gas of excellent combustible quality in increased quantity is obtained per ton of material handled, thus promoting fuel economy, notwithstanding that (say) 1 to 1½ gallons of crude benzol are extracted from the gas. The work that has been going forward has also shown the possibility of increasing considerably the quantity of fuel oils produced. In this connection users of internal combustion engines for vehicular purposes and for stationary engines have their eyes upon the gas industry as a potential home source of liquid fuel in competition with petrol. The shortage of petrol, too, has resulted in a large adoption of gas for motor vehicles; and the prospect is that, owing to its cheapness for this purpose—at any rate for commercial motor vehicles—coal gas is likely to have a permanent innings in this respect. The year, too, has witnessed a larger adoption of private tar-distillation plants, and a growing feeling that something useful can be done co-operatively. This has been accompanied by a desire on the part of the old firms of distillers to stem this tendency by entering into arrangements with the industry for a better sharing with the producers of the profits from tar. The difficulties with coal transport have found coke a welcome fuel. Larger experiences have been obtained with it and breeze especially for steam-raising; and, if care is taken, there is a prospect of a much larger market than heretofore for this primary bye-product, particularly for electricity generation. There is also a well-grounded opinion that the gas industry will become more intimately associated, as fuel suppliers, with their chief rivals. Yet the economic interests of the gas industry will be served. The compulsory use by home agriculturists of sulphate of ammonia, through the absence of other fertilizers, should have a marked effect upon the future of the home demand. These developments, in the aggregate, promise a considerable influence upon the future of the gas industry. They have enlarged our horizon; and in them it is hoped that considerable compensations will be found hereafter for the difficulties which the war has engendered for the industry in many ways.

Benzol and Toluol Extraction.

Into some of the matters just mentioned we may enter with more detail. Our columns have borne large testimony to the work the gas industry has been doing in helping the country and its Allies with the materials for the making of high explosives; and well-deserved was the graceful recognition of this that was made, at the meeting of the Institution of Gas Engineers in June, by Lord Moulton, Director-General of Explosives Supplies of the Ministry of Munitions, and now President of the Institution. Dr. Addison, in the House of Commons, about the same time, stated that in March, 1917, the capacity of the country for the production of high explosives was four times more than in March, 1916, and twenty-eight times more than in March, 1915. It is probable that to-day (excluding the coking industry) there are something like two hundred or more oil-washing plants in use in the gas-works of this country; and this number includes the largest undertakings, with a tremendous coal-carbonizing capacity. In the number, too, are, to their credit be it said, some of the smallest works, whose patriotic engineers have adopted oil-extracting plants—in certain instances home-made ones—in order to do their part in supplying the country with its needs. In some cases, where vertical retorts are used, the benzol recovered is unsuited for explosives making, owing to the high percentage of paraffins. Several hundred—probably eight hundred—works are also washing their gas by tar, but not so effectively as could be done with oil; and from some works, report says, the returns from the tar are not what they would be with good supervision. Anyway, on the assumption that the plants then in operation were worked consistently and regularly, we were asked to

announce in June that the authorities concerned did not, in view of the pressure for metals, think it desirable that materials should be devoted to the erection of further oil-washing plants, always excepting those that could be made from materials available on the works.

The year saw America, on its welcomed entry into the war, immediately devoting attention to the matter of improved benzol and toluol recovery; and considerable investigation was made into its resources. It was reckoned that before the war started, the output in the States was negligible; but it was thought that, with the plants in existence and under construction, the output at the end of this year would exceed sixty million gallons of pure benzol and twelve million gallons of pure toluol; and this without the resources of the gas industry. A Sub-Committee of the American Gas Institute extensively reported on the subject; and suggested that, if the Government needed toluol from the gas industry, one way of accomplishing it would be by the Government making contracts with the respective gas companies for the full production of at least one year, allowing a price sufficient to amortize the costs of the plants. They further submitted that the Government should advance the money for amortization during the construction period. In an order relating to calorific power, the Public Service Commission (First District) of New York mentioned that the War Department had communicated to them that a public emergency existed requiring the gas corporations immediately to enter into arrangements with the National Government, upon suitable terms of compensation, to begin the production, as soon as possible, of certain ingredients essential to the conduct of the war. In our Oversea Dominions, too, activity was seen in this direction. The Australian Gas Company announced their intention of adopting the process, while the Metropolitan of Melbourne Gas Company saw reasons why they should not instal plant at the present time. But it is understood that the Defence Department of the Australian Government propose to work plants for the production of benzene and toluene—the crude benzol to be obtained from gas-works.

The, for the British gas industry, new process of oil-washing, has been a fertile field for the exercise of the brains of gas chemists and engineers, with the view to increasing efficiency. Before our Associations and in articles, the contributions to the subject have been of a prolific character; and these, supplemented by working experiences, make an area of technical matter which it is quite impossible to even briefly survey within the limits of a retrospect. Every detail of the plants—the system of working, oil used, temperatures, results, experiences, &c.—has been overhauled in this country; and America, through the Bureau of Mines and the American Gas Institute, has made its contribution. The work dealt with has not only referred to extraction, but to the debenzolizing of the oil, including better temperature control. Among other things, through the work of the year, we have learned much as to the dependence of the efficiency of benzol extraction from gas, and indeed of debenzolizing, upon the ordinary laws of physical chemistry, and particularly upon the neutral solubility of oil and benzol and the vapour-pressures of the resulting solution. For the estimation of benzol in gas, and for application on the working scale, there has been interest in Dr. Lessing's patented system, in which an absorbent material (saturated with oil) is used in the scrubber; and the extracted hydrocarbons are subsequently recovered by volatilization by superheated steam applied to the scrubber itself. Mr. Harold E. Copp has also produced a simple apparatus for the estimation of benzol and toluol in gas. For the extraction of tar fog and increasing the efficiency of washing plants, Messrs. Fisher and Fiddes have introduced a highly efficient piece of apparatus.

It is now agreed, from what has been proved by experience as to the slight effect upon the calorific value of gas and its use under modern conditions, that oil-washing has come to stay, and that the gas industry after the war will take its place as producers in the benzol market. It would indeed be unthinkable that all the plant erected, and the work that has been done, in this connection should be abandoned, and that the industry should ever revert to the old conditions, when benzol is so much wanted at home—not only for national purposes of defence, but for many industries and for motor car use. The dye and colour industries require it; but their needs will not absorb more than a few million gallons of the make—probably, says one authority, 5 or 6 million gallons. Calculations show that—assuming all beehive ovens are converted to bye-product ones, that the gas made in the coking industry is completely stripped, and that all gas undertakings extract on an average only 1 gallon per ton of coal carbonized—the production of benzol would be well over 60 million, perhaps up to 70 million, gallons per annum. There will, however, be great developments of the motor car industry, and therefore of the output and use of motor cars. In view of this, there will be no lack of demand for motor spirit; and the more that is produced at home, so much the less will have to be imported. One of the first principles of national economics is that imports shall be kept to as low a level as needs demand, while exports shall be increased to the largest extent. The colossal oil companies have had their attention arrested by the growth of the competitor to petrol; and they have been feeling their way to get control of the production. The dye interests have seen this tendency, and have urged that in this direction there ought to be protection for their industry. It is pretty clear that the largest business for the gas industry will be for motor car use; and the Executive Committee of the National Gas Council have under consideration a specification for the production of benzol as a motor spirit. From several quarters there came the suggestion that, for mutual protection, an Association of Benzol Producers should be formed. The National Gas Council has announced that a Committee of producers are now considering various proposals for the distribution and marketing of benzol after the war.

A good deal of discontent has been evinced over the price that is being given by the Government for benzol, which is not a paying one for some companies who are not well situated for disposing of their product. The matter, which was raised in our columns by Mr. Frank Livesey, was considered by the National Gas Council; and there were interviews with the Ministry of Munitions. But nothing could be done at the time. At the recent meeting of the National Gas Council, Mr. D. Milne Watson announced that the Government were going to pay an additional 2d. per gallon for crude benzol produced in non-Government plants. Towards the end of the autumn, the Ministry of Munitions made a fresh order controlling dealings in creosote, benzol, crude naphtha, and light oils.

NAPHTHALENE TROUBLES.

The revival of the naphthalene trouble, owing to oil washing, continued to be the subject of discussion; and the Institution of Gas Engineers issued a very useful brochure, for the contents of which Dr. H. G. Colman and Mr. W. E. Price (the Hon. Secretary) were responsible. It was shown that there is no reason why, if the conditions are all right—if condensation is sufficient in summer to reduce the naphthalene content of the gas, if care is taken in regard to working temperatures, and the use of a wash-oil not surcharged with napthalene, if solvent vapours are added to the washed gas in quantity sufficient to compensate for those removed in the process of washing for benzol and toluol, or to maintain the right proportion of solvent vapours in relation to the naphthalene present in the gas—there should not be complete immunity from trouble from deposits, assuming freedom from any old deposits. The quantity of solvent added depends to some extent on the amount of naphthalene in the gas and the nature of the solvent; but generally it is found that the addition of 10 to 15 gallons of solvent per million cubic feet of gas, in addition to that already present, is quite sufficient to ensure freedom from trouble, providing there are no old deposits.

THE DYE-PRODUCING INDUSTRY.

In the foregoing, reference is made to a suggestion that the Government should after the war protect the dye industry in respect of raw material. It may, in addition, be mentioned that British Dyes Limited made good progress with works and plant, so far as the curtailments of war conditions would allow, together with the development of research laboratories. But there is one thing that is feared; and it is that progress in the provision of capital and output is not proceeding fast enough—more especially seeing that the leading dye-producing firms in Germany have combined for mutual protection after the war. Five of these show assets amounting in the aggregate to upwards of 35 millions sterling, including cash reserves of approximately 10 millions sterling. America and Japan are now busy making dye-

stuffs, as they do not intend contributing in future to Germany's revenue through these channels in the manner they have done in the past.

CALORIFIC POWER, INCOMBUSTIBLES, AND DILUENTS.

No one can measure the important part that the washing of gas for providing for national requirements has had in shaping the future course of the gas industry. The Standard of Calorific Power Act was a direct issue of the adoption of this process. Under this Act, altogether to date some 117 applications have been made to the Board of Trade and the Local Government Board; and in respect of them to date between 70 and 80 orders have been made. In all these the illuminating power standard has disappeared, and the calorific one has taken its place. In the case of applications to the Board of Trade, there was organized opposition on the part of both local authorities and the railway companies. A uniform standard of 500 B.Th.U. has been the rule, with 15-10ths minimum pressure, and sanction to make applications for revision after five years. The request of the South Suburban Gas Company that a standard of 475 B.Th.U.—the penal limit to which they are already working in regard to three-quarters of their output—should be applied to the whole of their area, was refused. The Board preferred to leave the decision of this matter to Parliament. In passing, it may be mentioned that during the year regulations for calorific power testing in Paris were issued; and in America frequent references were made to the question of standards.

INERT CONSTITUENTS IN GAS.

But the home position claims our chief attention. A very important thing happened. Suggestions were made that the inert constituents in town gas should be limited; and in the case of the East Grinstead Gas Company, it was asked that a limit of 10 p.ct. should be applied. The Board of Trade, however, refused to interfere in this matter, regarding it as a question that required investigation and statutory treatment. Subsequently, they referred to the Board of Fuel Research the subject of the most suitable quality of gas to be supplied, and the minimum pressure; the Board to have regard to the question of economy in the use of coal, the adequate recovery of bye-products, and the purposes for which gas is now used. Prior, however, to this matter being raised before the Board of Trade, it had come to our knowledge that systematic tests had been made of gas supplied up and down the country; and in the "JOURNAL" repeated warning was given as to what was happening, and the probable consequences in the way of additional regulation. Tests of which we had cognizance—these, of course, among the worst—showed varying percentages of inert constituents from about normal up to over 30 p.ct. Naturally, the washing of the gas had had some effect in raising the percentage, as well as the inferior quality of coal that was being supplied. The higher percentages, however, were monstrous and unjustifiable, and they have much to answer for. All avoidable incombustibles in gas are a fraud upon the consumers, inasmuch as they mean the payment for something which detrimentally affects flame temperature; and they are just as uneconomical, and therefore as objectionable, to the user of gas as are inert constituents in coal to the carbonizer for the production of gas and other commodities. It was mentioned at the last meeting of the Southern Association, by Mr. G. M. Gill, that the South Metropolitan Gas Company were working strictly to not exceeding a 10 p.ct. nitrogen standard, and a 2 p.ct. carbonic acid and oxygen standard; and other engineers are of opinion that they, under their conditions, could keep down to a 12½ p.ct. standard, though Mr. John West has suggested a 1½ p.ct. margin—making 14 p.ct. However, the Board of Fuel Research is considering the matter; and so are the chief organizations of the gas industry—the position at the moment being that the Board of Fuel Research will, as early as possible, have placed in their hands a report of the Gas Investigation Committee of the Institution of Gas Engineers and Leeds University (in the work of which Prof. J. W. Cobb is taking a leading part, with Mr. James W. Wood, M.Sc., as Research Chemist), together with the considered opinions and reports of the Institution, the British Commercial Gas Association, the Gas Companies' Protection Association, and the Society of British Gas Industries. The report of the Institution Gas Investigation Committee will not only deal with the question of inert constituents, but with the varying intrinsic qualities of gas. From all of this, and in view of the abuse that confessedly has taken place in some quarters, it may be anticipated that the yoke of further regulation may be placed on the industry. Some interesting information as to flame temperatures and inert constituents was included in the Presidential Address of Mr. R. Nelson to the North of England Association.

BLUE WATER GAS AN AID TO MANUFACTURING ECONOMY.

Development upon development. The subject of inert constituents in gas brought to the front the question of Adulteration *v.* Dilution; and dilution pointed the way to economy. In Germany to save coal and oil, a percentage of blue water gas was being mixed with the coal gas; and our own Coal Controller, advised by Mr. Thomas Glover, had (as already seen) recommended that, in order to save coal and carriage, combined with the oil position, gas undertakings should utilize their water-gas plants for making blue water gas, and mix a suitable percentage with well-made coal gas. Several undertakings did this, and are still doing it. At Norwich and Colchester, for example, up to 25 p.ct. of blue water gas is mixed with the coal gas; and, despite washing, gas of a calorific power of 500 B.Th.U. is being supplied—the gas containing 90 p.ct. or so of combustibles. Mr. W. R. Herring, in a lecture to the Scottish Junior Gas Association, stated that, in his own experience, 33 p.ct. of blue water gas could be added to good coal gas, and the mixture (with a combustible content of 90 to 93 p.ct.) have a calorific value of 500 B.Th.U. In such experiences are the death-knell of avoidable incombustibles, the directing finger to a greater economy in the production of town gas, and the way to coal economy, while affording a permanent outlet for a proportion of coke. As a matter of fact, it is hoped that the future requirement for oil in the gas industry will be a diminishing quantity. But all this is only an opportune revival in which the "JOURNAL" took a prominent part during the year. Our back volumes contain the records of what Smithells, St. Claire Deville, Colman, Abady, and many others have said as to the effect of inert constituents upon flame temperature, and of what many men have said as to the mixing of blue water gas with coal gas as an aid to manufacturing economy, not only through its cheapness, and good combustible character when properly made (directions for which have been issued during the year by the Institution of Gas Engineers), but through the proportionate saving to be effected on coal purchases, storage and handling, retort plant, labour, wear and tear, and so forth. The economy is of a cumulative character; it is quite a mistake to think that calories are the only things for consideration. In connection with these developments, an article appeared in the "Chemiker Zeitung," from which it was seen that in Germany, consideration is being given to similar lines of economy, and a system was described patented by the Dellwik-Fleischer Wassergas Gesellschaft and E. Dolensky for converting coal directly into heating gas, bye-products, and ash. It was urged in this connection that the use of solid fuel should be prohibited in Germany, and that a mixture of water gas and coal gas should be distributed for general use as a heating agent.

The attitude taken up by us in the matter of dilution with blue water gas had a stream of encouragement from many quarters, privately and for publication—among the latter from Mr. Charles Hunt, who emphasized the importance of the question from both the industrial and domestic standpoints, and intimated that the South Suburban Gas Company (of which he is the Chairman) were carrying out an inquiry into the matter. Advocacy was also found in Mr. A. E. Broadberry's Presidential Address to the Institution of Gas Engineers. Mr. Thomas Glover, too, showed in our columns how his analysis assured him that, where unduly inflated gas productions were found (apart from the detriment to consumers), the cost was from 2d. to 3d. per 1000 c.ft. more—an exception being vertical retorts where high makes are obtained under level-gauge conditions—as compared with gas-works where blue water gas was the method of effecting economies in the use of fuel. Mr. J. O. V. Irminger, in a letter, told how in Copenhagen he had been, owing to stress of coal supplies, supplying equal mixtures of coal and blue water gas, of approximately 450 B.Th.U. gross. Testimony, too, came from Mr. James E. Enright and Mr. C. B. Tully as to experiences in the supply of 400 B.Th.U. carburetted hydrogen gas. Manufacturers of gas

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appliances expressed the view that they would rather, where appliances were fitted with air-adjustment, prefer a lower calorific power gas than a higher calorific power one containing an inordinate percentage of inerts. In gas-furnaces, engines, fires, and other heating appliances, the bad effects of an undue amount of incombustibles have been seriously felt by consumers, and have done the gas industry no good. Defective working became so notorious that the Engineering Correspondent of the "Daily Telegraph" advised manufacturers using gas for heating purposes to specify, as a condition of their gas-supply contracts, that the inert constituents should not exceed a certain maximum.

STEAMING IN VERTICALS.

Blue water gas for diluting a well-made coal gas is one method of effecting economy in gas-works; steaming in vertical retorts, another. A large amount of light was in the course of the year thrown on what is being done in this direction; and it promises well. The results of steaming in intermittent vertical retorts working at various places was given by Mr. F. G. Ambler in a paper before the Irish Association; and Mr. R. Nelson dealt with the subject in his Presidential Address to the North of England Association. But Mr. John West and Mr. J. E. Blundell, respectively at meetings of the Southern Association and the Manchester Institution, gave some remarkable testimony as to the value of steaming in Glover-West continuous vertical retorts; and there is no doubt from the data advanced that, with this system of working, continuous steaming assists not only in protecting the hydrocarbons, but it accelerates their exit from the retorts, and thus helps to prevent their degradation. The results are seen in the high makes of mixed gas, the good calorific values, and the low inert constituents. Mr. Blundell showed a make of upwards of 15,000 c.ft. of 510 B.Th.U. gas, and spoke of trials in which 17,000 c.ft. had been obtained; Mr. West gave figures running to over 17,000 c.ft of close upon 500 B.Th.U. gas; and Mr. Lawrence Hislop mentioned trials in which he had run up to various makes reaching as high as 20,000 to 23,000 c.ft. of from 460 to 470 B.Th.U. It is also seen that the tar and the fuel oils are quantitatively increased; this being due to the fact that while the external carbonizing temperatures are high, the constantly incoming coal at the top of the retort results in that part of the charge being carbonized at relatively low temperatures—thus producing oils of the paraffinoid order rather than of the benzenoid. In the discussion on Mr. West's paper, Dr. Colman pointed to one set of data from which he calculated a production of some $7\frac{3}{4}$ gallons of fuel oils, as compared with (say) 3 gallons in ordinary retort working. Dr. Perkin also pointed out that returning to the retorts gas stripped of benzol and toluol increased the tar by some 2 to 3 gallons. An essential feature of the working is that the heats have to be higher than was formerly the case at the lower part of the carbonizing portion of the retorts, in order to keep down the CO_2 in the gas. In correspondence, it was pointed out that the ability to do this was absent in the Woodall-Duckham continuous retorts, but that a comparatively simple rearrangement of the heating plan would enable it to be done. Yet another point that was made was that, while it has been proved that continuous vertical retorts can carbonize any coals, the efficiency of steaming depends to some extent upon the physical characteristics of the coal. For instance, nuts are preferable to slack, as they secure a porosity in the charge. This work of the year is all very satisfactory; and it shows that our carbonizing possibilities (we ought to mention, too, the remarkable results promised by the complete gasification of coal) are far from being exhausted.

LOW TEMPERATURE CARBONIZATION.

One thing that emerged from all this discussion, and from the suggestion of the Ministry of Munitions that, in order to produce more fuel oils, gas-works should adopt low-temperature carbonization, was that low-temperature carbonization is quite unfit for present-day gas-works requirements, and that it would be disastrous to economy. The retorts themselves with their heavy charges are unfitted for low temperatures, more plant and more labour would be needed to deal with the larger quantity of coal necessitated to make the gas required, and the additional production of fuel or creosote oils produced per ton of coal would not compensate for the losses occasioned by the lower production per unit of plant. To cut a long story short, it was found that, while the result in fuel oils would increase per ton, on balance the cost would be so prohibitive and disastrous to all works without spare carbonizing plant sufficient to compensate for the reduced gas output by low-temperature working, that the suggestion made by the Ministry of Munitions was withdrawn. Moreover, the Ministry could not have low-temperature carbonization, without affecting benzol and toluol production, and increasing the output of the paraffinoid bodies that are detrimental to explosives manufacture. However, it is clear that there will be no occasion to trouble further as to which low temperatures or high temperatures are correct for gas-works purposes. Even the advocates of low-temperature systems are agreed upon this, except certain enthusiasts who appear to know about as much of the economic aspects of the matter as the man in the street.

Low temperature processes require small dimensioned retorts, and have objects distinctly their own, or perhaps we should say retorts in which the coal can be carbonized in comparatively small diameter charges or thin sections, so that the coal charge is kept compact. Mr. F. D. Marshall discriminated in our columns between low and high temperature carbonization, by pointing out that the degree of temperature required for the production of saturated or the benzol series of hydrocarbons is not lower than 1400° Fahr.; and to obtain the full value the temperature has to be raised to those approximately of gas-works practice; while at temperatures below 1400° Fahr. unsaturated hydrocarbons or paraffinoids are obtained, with (at 1000° to 1200° Fahr.) traces only of the saturated hydrocarbons. It has also been shown that the ammonia recovered is in much smaller quantity with low-temperature carbonization than with high temperature; though, of course, if the coke be gasified with both systems, a large proportion of the ammonia left in it could be recovered. But if the coke is to be gasified from the low-temperature processes, where is the advantage of leaving in it (say) 10 p.ct. of volatile matter? In their report, the Board of Fuel Research indicated that they were not satisfied with the information so far published as to the low-temperature processes. They considered there is much to be done in devising special forms of apparatus required for the economical carrying out of this type of carbonization. They pointed out, too, that no new carbonization scheme can be justified economically if it can only live by poaching on the preserves of existing industries. Even if an efficient system of low-temperature carbonization is evolved, it will be valueless in the wider sense, unless profitable outlets for all the products can be developed.

There were rumours of large projects on one or other of the low-temperature systems ef carbonization, and of actual movements being made in the establishment of chemical and electricity producing works with a low-temperature system at the base of the operations. At the meeting of the Coalite Company (whose original patent is more than eleven years old) there was considerable talk of prospects, though the Barnsley Fuel Company's plant was not then finished. In the early part of the year, the consent of the debenture holders was obtained to the granting of a licence to a new Company to utilize the Company's process in the United Kingdom; and there has since been a fresh development for working the plant with Low Temperature Carbonization, Ltd.—the agreement appointing this Company Manager of the business of Coalite, Ltd., for a term of ten years. The shares have advanced in market value—on the strength of what? We search in vain for the answer. Government Departments have also continued to interest themselves in, and have made research into, low-temperature processes other than the Coalite.

THE SECONDARY PRODUCTS.

COKE.

Much of all the work described bears upon the question of improving the aggregate value of the secondary products of coal carbonization. What has to be done is to realize as much as possible, in order to make the net cost of our primary product as low as possible.

Prior to the opening of the war, coke had been having a bad time; but since, owing to the shortage of fuel through the difficulties of distribution, it has been absorbed at good prices, and many excellent customers have been obtained for it. There is control of exports. The sale has also, in the Metropolis, come under the Coal Controller's department, the same as coal; and Mr. Calthrop secured, as pre-

viously stated, the services to assist him in this connection of Mr. E. W. L. Nicol, the expert to the London Coke Sales Committee. But first as to exports, the Board of Trade returns issued each month do not now give details under this heading. Coke is lumped-in with coal and patent fuel; but there is no reason to suppose that, claims of the home market notwithstanding, there has been any diminution of the amount shipped this year as compared with 1916, when the quantity was larger than in any year since and including 1913—this, of course, embracing metallurgical coke. But we have to remember the coke accumulations previous to the war, and see that the practical experiences during the war are turned to advantage afterwards.

The Coal Controller, to save transport, has recommended the utilization of the coke supplies to the fullest extent. In most districts there was little need for the recommendation; for, in the periods of greatest fuel consumption and pressure, there was little surplus stock at the gas-works. The work of the London Coke Sales Committee and Mr. Nicol, which had already borne good fruit, had its greater reward in the ease with which users of steam found they could turn from coal to coke for its generation. The constant discussion of fuel economy and the need of recovering the valuable products of coal, also had an effect in concentrating attention upon coke. Many electricity stations had part of their furnaces fitted with mechanical stokers and forced draught arrangements for burning with coke and coke breeze, and economies were reported—notably from Marylebone. Mr. Nicol has gone further, and has put forward a scheme for a closer alliance of electricity undertakings, whereby steam-raising plant could be placed on gas-works, and incandescent coke from the retorts be passed direct to the furnaces of steam-boilers—in this way promoting both thermal efficiency and economy. The use of coke for motor vans and omnibuses made progress; and the saving in running costs in comparison with petrol was shown to be considerable. Public baths, too, announced savings by its use. The utilization of blue water gas for diluting coal gas, and steaming in vertical retorts, also mean a permanent profitable utilization of coke at home, and altogether independent of the oil market. The gasification of coke for the production of power gas, combined with the recovery of the ammonia in the coke, has been receiving attention; and there ought to be a field here for the development of a large industrial gas business. The low-temperature process advocates do not say so much now about the provision of an ignitable coke for domestic use; they see in its gasification and the disposal of the gas with the stripped gas from the coal a more profitable way out of one of their commercial difficulties. In the cause of fuel economy, Mr. W. Chaney, of Birmingham, described in a paper the advantages of utilizing in gas-producers coke dust up to 40 p.ct., mixed with 60 p.ct. of coal slack containing a proportion of nuts, giving a gas of 130 B.Th.U., and recovering per ton of the mixture of fuel 69 lbs. of sulphate of ammonia. The prevailing low price of pitch, and the relatively high price of even the cheapest fuels, resulted in giving an impetus to briquette making; and it was learned that a large number of orders have been placed for briquetting plants.

Tar.

With regard to tar, it is evident the gas industry does not intend to revert to the poor paying position of this that existed before the war. Tar dehydration plants (to the technical improvement of which some attention has been devoted during the year) have shown what can be done not only to supply the local requirements for road purposes, but to make a better price for the valuable derivatives. Tar dehydration plants, however, are only what they are represented to be, and have a poor efficiency as compared with complete tar-distillation plants. Several additional undertakings are adopting tar distillation; and for concerns that cannot do so, there was continued advocacy of the establishment of co-operative tar distilleries and refineries by groups of gas undertakings, with the dual view of saving the cost of distant transport, and of making a better value from tar than has hitherto been the case by its disposal to the tar distillers, or alternatively arrangements with large gas undertakings to take the tar of their smaller neighbours for distillation. A further incentive to this movement has been the fact that, despite the tar-washing of gas, and the consequent improvement in intrinsic value of the tar, many of the tar distillers have been reluctant to pay, and some have not paid, for the augmented value. The tar distillers have apparently been aroused as to the error of their ways; and there have been negotiations with the National Gas Council which have resulted in proposals for a profit-sharing arrangement. The upshot of this has still to be announced; but it is hoped by the Council that an arrangement mutually advantageous to distillers and producers will be arrived at. By the way, not a few gas undertakings have experienced difficulty in disposing of small quantities of light oils obtained from dehydrating plants owing to the railway companies refusing to accept it in barrels and drums.

Reverting to the use of tar for road purposes, the Road Board announced that they were again distributing during the year £200,000 towards the preservation of roads—principally for tar treatment of main county roads. Owing to the position of fuel oils, the Ministry of Munitions placed restrictions on the use of creosote oil; then came an order putting under control all dealings in crude benzol, crude naphtha, and light oils; and later one referring to tar and tar oils. The users of Diesel engines (so many of which have been converted for the use of tar oils) found these restrictions irksome; and steps were taken to secure for users licences for longer periods than two months. Trials of mixtures of pitch and creosote are being carried out. Tar has appeared at various times before the Patents Court; and among the applications was one for the use of a German patent for "Flavine," which is a specific with powerful bactericidal and antiseptic properties, and striking evidence was given as to its virtue in the healing of wounds.

Sulphate of Ammonia.

Sulphate of ammonia has had a varied history. There is dissatisfaction with home controlled prices; but there is some satisfaction with what the Board of Agriculture and the Sulphate of Ammonia Association have done to create a demand for the sulphate, as it is believed that considerable good will accrue from this after the war. But there is always the danger of building one's hopes too high; and hopes in this connection must always be tempered by the knowledge that after the war synthetic and other fertilizers will be taking a commercial offensive. This country in this regard has learned something from Germany, which made itself, through the extraction of nitrogen from the air, and the extension of the Haber process, absolutely independent of nitrate from Chile. As a result of the work done by the Nitrogen Products Committee of the Munitions Inventions Department, this country is also going to make itself as independent as possible of overseas production, which does not look well for nitrate of soda, and is certainly not going to improve the position of other existing fertilizers, unless simultaneously the country is made more self-reliant in the matter of food production, and some protection is given to all home-produced fertilizers. At the last meeting of the Nitrogen Products and Carbide Company, the Chairman (Mr. A. E. Barton), speaking of the production of granular nitrolim, said, with the large amount of water power at the disposal of the Company, they would be able to assist not only this country but the whole world by the production of a cheap nitrogenous fertilizer.

However, the present position of sulphate, except in regard to the controlled prices for home application (comparatively little is allowed to be exported), is not at all unsatisfactory in regard to home demand; and it promises to be still larger in the coming year. As to the controlled prices, they were fixed in the early part of the year, on a 24½ p.ct. basis, in makers' bags, net cash delivered to consumer's station, in quantities of not less than two tons (prices for smaller quantities are also fixed), at £15 7s. 6d. per ton from June 1 to Sept. 30, at £15 15s. from Oct. 1 to Dec. 31, and £16 7s. 6d. from Jan. 1 to May 31. These prices are subject to a discount for cash of 10s. to manure makers, agricultural merchants and dealers, and co-operative societies. Several conditions attached to this arrangement, which raised a storm of protest from producers, who felt that, in view of the high controlled price of sulphuric acid and the cost of labour, they were being sacrificed for the agriculturists, who are under the Corn Production Act, and controlled prices for their produce are remarkably good. However, the Sulphate of Ammonia Association are hopeful. They have prepared a statement for the authorities showing that the producers are getting a far less good return from sulphate at present prices than before the war; so that, when next prices are under discussion, producers may get more equit-

able terms. Towards the close of the year, consumers were making efforts to secure a large portion of their spring requirements before the increased price became operative.

What came to be known among producers as the equalization scheme had a short life. The intention of the scheme was excellent, but too indefinite both from the quality standpoint, and in regard to the increased revenue to be obtained from the exported product—the idea of the scheme being to enable makers in agricultural districts to sell the whole of their makes for home consumption, and at the same time obtain a fair share in the higher prices for export. A new delivery scheme was introduced, by which 10s. per ton was obtained from the prices credited to the Government, who undertook to defray the whole expenses of transit. Added to their other obligations, the Sulphate of Ammonia Association took upon themselves the position of sole sellers of sulphate of ammonia for export and munitions. A matter of importance in the sale of sulphate is that the Association are anticipating that, from experiments now proceeding, sulphate will in future be made acid free and with a minimum of moisture. If neutral sulphate can be successfully made, it means good protection for bags. In connection with food production, various Committees were appointed; and the bodies who became interested in sulphate became so complex that it was a matter of some difficulty to keep track of them.

Messrs. Bradbury and Hirsch as well as Mr. W. S. Curphey, the Chief Inspector under the Alkali Works Regulation Act, reported an increase in 1916 in the production of sulphate compared with the two preceding years. The figures given by the latter, expressed in terms of sulphate, were for 1916 433,703 tons, in 1915 426,267 tons, and in 1914 426,412 tons. Of the total for 1916, 70,987 tons were produced in the form of concentrated ammonia liquor; while the balance was the total of all the other ammonia products—the sulphate, chloride, nitrate, &c. The production from gas-works, shale-works, and producer-gas plants showed a slight falling off. In the case of gas-works, we fancy the falling-off should be attributed to the quantity of inert material in the coal. Regarding the manufacture of concentrated ammonia, Mr. J. W. Lee gave some useful information in his Inaugural Address to the Midland Section of the Coke Oven Managers' Association; and an article by Mr. P. Parrish, dealing with the address, appeared last week. In his report, Mr. Curphey supplied information as to the low recovery of ammonia with the direct process.

Sulphuric Acid.

Regarding sulphuric acid, throughout the year there was great difficulty in obtaining regular and satisfactory supplies; and the controlled prices were placed at a higher figure—from 10s. to £1 more per ton according to quality and whether arsenical or non-arsenical or dearsenicated acid. Compared with pre-war prices, the price of the latter (class "B") was some 150 p.ct. more. As we said at the time, if there was to be any real national value in Government control, there was no justification in these figures. Early in June a fresh order was issued by the Ministry of Munitions regulating manufacture and controlling the sale of sulphuric acid; and a more detailed schedule of maximum prices accompanied this. But it is hoped that after the war prices will be lower than even before the war. Not only has production for war purposes increased in private establishments, but in the specially constructed Government factories. Says Dr. Addison, whatever arrangements are made for the future, it is essential to secure that sulphuric acid is made available to *bonâ fide* users at fair rates; for if this is done it should lead to the establishment of an important group of industries. But the sulphuric acid makers have been crying out; and Sir William Pearce, in the House of Commons, was heard to bemoan a possible redundancy after the war. A proposed National Sulphuric Acid Makers' Association was advocated; but nothing appears to have been done in connection with the original proposal. However, in the report of the Executive Committee of the National Gas Council published in November, it was stated that proposals were being made to form such an Association; but they were awaiting the publication of a report of the Departmental Committee on the subject before advising the gas industry.

Complaint was made as to the inferior quality of the acid supplied, as well as the shortage of supplies. Reference was made by Mr. Curphey in his report to the use of crude pyrites acid for sulphate production, and the difficulty experienced with the precipitation of metallic sulphides in the saturation; and he also recalled an old method of dealing with this. As to the shortage of supplies, this is partly responsible for reducing the amount of sulphate that could otherwise have been produced. The question was revived as to the partial use of nitre cake; and Mr. Parrish demonstrated that there was no insuperable difficulty in using nitre cake to produce a mixed salt containing 10 p.ct. of sulphate of soda. He offered valuable hints and suggestions on the subject. Dr. Voelcker has asserted that the presence in sulphate of ammonia of sulphate of soda (derived from nitre cake) does not constitute a bar to its employment; and Dr. Bernard Dyer's and Mr. Parrish's work confirms this. Suggestions were again made that gas-works should themselves enter more largely into the production of sulphuric acid from the sulphur that they produce; and coke-oven owners were advised to recover sulphur, and do the same. In a paper before the Society of Chemical Industry, Mr. H. M. Ridge held out the hope of a considerable cheapening of sulphuric acid by the utilization of the sulphur contents of zinc ore.

Nitrate of Ammonia.

Twice in the year—first before the Society of Chemical Industry and subsequently the Midland Section of the Coke-Oven Managers' Association—Mr. E. Kilburn Scott advocated the conversion of the ammonia recovered in coal carbonization into nitrate of ammonia (instead of sulphate of ammonia) by means of nitric acid produced by the fixation of nitrogen from the atmosphere by electric power. A good deal of the success of his proposals depends upon the availability of electrical energy at ⅛d. per unit. This he proposed to realize by utilizing the waste gas and heat for the generation of the power. As we showed at the time, there was a good deal that was speculative—technically and commercially—about the case which he presented. Nitrate of ammonia is deliquescent, and in our wet climate this would prove a disadvantage. With reference to nitric acid, information came as to trials at the Nuremberg Gas-Works with the manufacture of nitric acid from coal gas and producer and low-grade gases by explosion; all the experiments so far suggesting that, by employing coke-oven gas, about 6¼ lbs. of acid per 1000 c.ft. exploded must be looked upon as the maximum. The Nitrogen Products Committee have been turning their energies to bringing to a commercial stage the ammonia oxidation process for producing nitric acid from gas-works and other forms of ammonia.

Nitrate of Soda.

During the year there has been comparatively little nitrate of soda available for the open market, on account of the requirements for war purposes and shipping difficulties—in fact, without permits, dealings were prohibited by the Ministry of Munitions. Hence the price has ruled high per unit of nitrogen. The work that is being done in connection with the recovery of nitrogen from the air, and the production of synthetic nitrate, is not being regarded with favour by those who are interested in the Chile nitrate of soda market.

Gas Development Prospects.

From what has preceded, it has been seen that the year's work has pointed to considerable openings for development both in carbonization and in secondary products, and that in these directions the horizon of the gas industry has been greatly enlarged. There are points in our prospects in one or two directions—notably in connection with sulphate of ammonia—in which events may prove that per unit of production, the industry, it may be, will have to be content with less return in the future than in the past. This, however, has to be confirmed by time. Anyway, it is necessary that there shall be diligent work to make this as light as possible, by added efficiency in the production of the sulphate, so as to affect in minimum degree the large compensations which are seen in other development. The incentives to new departures which are found in gas maufacture and secondary products traverse also the commercial paths of the industry's primary product. Given a cheap combustible gas, there is large promise in the development of demand; and therefore in the expansion of the very foundations of the industry, with consequent enlargement of the secondary products field.

Lighting.

In the field of lighting during the year, the street lamp, shop, and other lighting restrictions, including the Summer Time Act, have continued to repress business. But owing to weather conditions, combined with industrial requirements for munition work, some remarkable increases in consumption were witnessed. No striking developments in gas-burners or lamps have been seen; but this does not go to show that invention has been dormant. As a matter of fact, when the war is over, and our lamp makers have full possession of works again, with material and men, there is the promise that improvements will be witnessed. The control of street-lamps, particularly by the pressure-wave system, has made further advance in application. Mantle making has also made a great spurt in this country. In regard to the provision of thorium, we are now in quite a comfortable position; and geological and other research, and the intervention of the Government, have assured the industry in this respect. We shall in future be able to do without the interested assistance of Germany in this regard. Therefore, gas undertakings must decide that they at all events will not after the war do anything to assist the revenue of Germany through this channel; and every one of them should bring its influence to bear upon vendors and purchasers in its area to patronize only British productions, and take very good care they are British. The importation of mantles was prohibited during the year; and this, it is hoped, has cut off the supplies that, it was confidently believed, were coming under false descriptions from Germany *viâ* neutral countries.

Cookers and Water Heating.

Cooking by gas has during the year had a remarkable advertisement, through the food economy campaign, communal kitchens, and the equipment of munition works, barracks, camps, hospitals, and so forth. These have laid large claims on the reduced supplies of gas-heated appliances —reduced, owing to the claims on material, men, and factories by the requirements of the war. In the food economy campaign, the British Commercial Gas Association have taken prominent part—in fact, the lynx-eyed Executive and the staff have not allowed a single opportunity to pass in which the claims of gas could be promoted. Gas officials, too, have been active in rendering help to Local Committees in connection with the campaign. In the home labour-saving campaign, gas has had much prominence; and we have not the slightest doubt that every gas engineer is keeping in touch with what the local authorities are doing, in compliance with the plans of the Local Government Board, for, with the termination of the war, embarking upon a large housing scheme, in which modern conveniences will be adopted, in place of wasteful labour-creating ones.

Excepting what was absolutely essential, comparatively little has been done this year in connection with the water-heating part of the gas business. In this, as in the case of cookers, gas-fires, &c., supplies of appliances and labour have restricted the work.

The Gas-Fire Position.

Gas-fires were responsible for a great seasonal embarrassment of the industry, which has illustrated what, when we arrive at normal times, may be expected to become a somewhat common experience. The extraordinarily cold weather dipped deep into the early part of the year. Combined with this was frequently repeated advice to the public to use gas instead of coal, for the double purpose of helping to swell the source of ingredients for high explosives, and to save labour, as much as possible, for the winter conveyance of household coal, delivery of which at any time there was some difficulty in getting. These were a trio of reasons for the remarkably large use of gas for heating, which some days ran up to percentage increases on corresponding days which beat all the records. Upwards of 40 p.ct., and even 50 p.ct., were heard of as the increases of a day; and averages over the first three months of the year were common that were in the neighbourhood of 20 and 25 p.ct. With coal and labour short, it was the experience of a lifetime for many gas engineers; but they and their men and works maintained their reputation. The experience shows the necessity of being prepared with plant (when priority certificates and other drawbacks cease to worry) for meeting flights of consumption for domestic heating; and herein is seen the advantage of being able to supply a mixed gas, at least 25 p.ct. of which can be made quickly from a material that is the product of the manufacture of the other 75 p.ct. There are some pessimists who think the gas industry is going to lose a considerably larger part of its lighting load; there are others who are of opinion that we have about reached the level at which the gas industry's share will be maintained. Supposing the former are right, the domestic gas-heating business will more than cancel-out any loss in lighting.

However, these are conditions to keep in view, in company with the impressive growth of the domestic heating demand during the fore part of the year. At the South Suburban meeting in February, Mr. Charles Hunt told how the number of heating appliances on hire had reached the high average of 106 per 100 consumers; and at the Croydon Company's meeting, Mr. Charles Hussey mentioned how in their case the stoves on hire averaged 107 per 100 consumers. Had conditions permitted, these averages would have been exceeded. But they did not. Supplies were not so freely forthcoming as during peace times, through the scarcity of materials and labour for anything much beyond war work; while another factor was the position of many undertakings in respect of plant, coal, and labour in meeting additional demands for gas. The experiences of the year showed the necessity of taking a liberal measure of future possibilities; and so some administrations concluded it would be wise to refrain from accepting orders for new connections, while others decided not to seek new business, and to deal only with that which came along uninvited. Regarding the fires themselves, the makers have been confining themselves to previous patterns, though we know that new and lighter designs are in preparation for the good time to which all are looking.

In the Industrial Field.

It is in the industrial field that the war has developed the use of gas at a rate that would have taken ordinary propaganda work many years to have achieved. Good experience ever breeds demand. And the high tide of demand for gas-furnaces that has ruled for munitions work will continue to permanently influence heating methods in the industries. This is assured. Mr. Thomas W. Fletcher in articles in the "Journal" showed how marvellous had been the development of gas-furnaces, and proved that this is no mushroom growth. Mr. Arthur Forshaw, M.Sc., gave us an insight into the technical work that is proceeding at the works of Messrs. John Wright & Co., with the object of eliminating the weaknesses in detail that experience under the divers circumstances of use had disclosed, and how success had attended, and was attending, these efforts. But he also urged gas undertakings to do their part in the development by supplying gas of the quality required. In Mr. Forshaw's lecture, in visits to the works of Messrs. John Wright & Co. and the Davis Gas-Stove Company, there was impressed upon us the necessity for furnaces being made for the work, and not an attempt to adapt work to just any furnace—such a proceeding being fatal to efficiency. In Mr. H. M. Thornton's Society of Arts paper, some remarkable figures were given as to the increase in the industrial use of gas, with illustrations of the appliances through which this increase had been obtained. Demonstrations of furnace working were given to manufacturers in London, Manchester, and elsewhere; and several gas undertakings have equipped special demonstration rooms. The Institute of Metals have at two meetings during the year shown their interest in the subject; and in papers before other Associations it has been proved what a very live subject this is. But the result. The demand for gas for furnaces in connection with munition works has taxed the full capabilities of the gas-works in some of our largest cities—works that before the war had a very fair margin—so much so that Birmingham has had to ask domestic consumers again this winter to economize, so that the munitions works shall not go short.

Gas-Engines.

While industrial heating has been moving with giant strides, gas-engines have been taking their place with vigour in the great requirement for war output. The quick revolution gas-engine, especially for the higher powers, has been

much in demand; and Mr. V. E. Green lately showed us how great is their efficiency, and how well they are meeting new applications—particularly, owing to the remarkably even turning moment obtained, in the generation of electricity. From America came information as to construction for steel works of gas-engines of 4000-H.P., which were to be employed both for blowing and for driving electric motors. Captain Riall Sankey, delivering the "Thomas Hawksley" lecture, mentioned that gas-engines of 5000-H.P. had been built in America and Germany for dynamo driving and blast-furnace blowing engines; and in 1915 Prof. Hubert stated that an 8000-H.P. engine was before the war being built at the Cockerill works. Gas for power purposes is passing from the lower powers to the higher; and it is a question for consideration whether in some industrial areas, the gas-works is not the place at which the gasification of coke, with ammonia recovery, should take place for the provision of a much cheaper industrial gas. We have never known a year when so many industrial applications of gas have been noticed in the "JOURNAL."

MOTOR TRACTION.

The gas industry has had sprung upon it a new development in demand—that is, for gas for motor vehicles, owing to the shortage and the high price of petrol. The shortage is due to shipping and to the requirements of the Government; and the Petroleum Executive of the Ministry of Munitions—particularly through their energetic Economy Officer, Mr. E. S. Shrapnell Smith—has been busy fostering the use of gas in place of petrol. The British Commercial Gas Association, too, have through literature, through an investigation conducted by Mr. J. G. Clark, and through a discussion at their annual meeting, been taking a large part in the matter. But in many places owners of buses, commercial vehicles, private cars, and taxi-cabs have required no outside stimulus to apply various fashions of gas storage in order to run their vehicles. Some of the early temporary flexible containers looked grotesque; but the newer styles are getting somewhat more trim, and people are not gazing at them to-day, as they were only a few months ago, with astonishment. The flexible container is more or less a temporary expedient; but the enlightenment that has come, that gas at 2s. per 1000 c.ft. is equal for traction purposes to petrol at 6d. per gallon, and at 3s. to 9d. per gallon, has set people who have to pay for motor fuel looking to this business for gas as permanent. Thus brains have been at work in devising light cylinders for the storage of gas under compression. It is true that in some cases a loss in engine efficiency is found of (say) 15 to 20 p.ct., by just the change from petrol to gas; but the probability is that this will be diminished with experience and proper adjustments. As a matter of fact, the experience of some users is that the load capacity has not been interfered with by the change.

In certain cases, unfortunately, gas undertakings cannot, through pressure on their gas resources in these times, and the impossibility of extending them, accept the new custom; but gas districts are close together, and circumstances vary. Gas engineers have, however, had to turn their attention to the best means of meeting the demand, and have been busy discussing the questions of connections, metering, charges, and all the detail attaching to the new business—the idea being that, other than in the matter of charges, there should be universal practice, so that containers may be filled anywhere. They themselves are also showing their willingness to help the Government by the converting of their own motor lorries and vans from petrol to gas use. At the present time, there are many thousands of vehicles running on gas; and the manufacturers who undertake the conversion are busy with the orders that are pouring on them. There is some talk of the Government not allowing the work to proceed for vehicles for which petrol licences have not been issued; but it is to be hoped that this does not mean in the case of vehicles that would improve—improvement is much needed in these days—industrial and commercial road transport. In connection with the charging of vehicles, local authorities are raising no objection to a conditional erection of stand-pipes; and certain gas undertakings in Parliament this year are asking for the necessary power. Meanwhile, the Petroleum Executive have appointed a Gas Traction Committee, of large and strong constitution, upon which the gas interests are well represented by Mr. W. Doig Gibb, Mr. Charles Carpenter, D.Sc., Mr. F. W. Goodenough, Alderman W. Kay, while Mr. Shrapnell Smith is for the time being acting as Secretary.

"FINANCIAL HARDSHIPS"—THE SLIDING-SCALE AND MAXIMUM PRICES.

In the foregoing an endeavour has been made to show how the industry stands in the matter of possible development; and the prospect is bright with promise. Had it not been for the high prices of coal and everything that the industry requires for its business, including capital as well as goods, and the shortage of materials and labour, these war years, despite restrictions, would have been highly profitable ones. But the reverse has been the case. The price of gas has been put up to figures that are only matched by reference to the long-past records of each undertaking; and over not a few undertakings hangs the necessity for a further increase, owing to the allowance of 2s. 6d. per ton to the colliery owners in consideration of the recent increase of the miners' wages. This brings us to the point of the sliding-scale. The principle of this is good with only the fluctuations of normal times; but it is distinctly unfair to capital when the outgoings take such a rapid and distant flight that a considerable part of the return on capital completely vanishes. Abnormal conditions demand abnormal consideration and treatment. This has been recognized by the Government throughout the war, and it is hoped that Parliament will agree that the claim to a fair return that gas capital is making is based on justice. It is a proposition that cannot be contested—though a certain organization of local authorities may make the attempt—that gas consumers are not paying a fair price for gas if it does not, in the prevailing circumstances, permit of a fair recompense to the capital employed in their service.

This question of the war time financial conditions of gas undertakings was raised in the "JOURNAL" in the autumn of 1914; and it has been a constant topic ever since. The matter was taken up here and there where the conditions pinched the hardest. But those who urged that the matter was one that should be taken up as one of general concern to the industry were told that it was a question for an individual application to Parliament. Others there were who, admitting that, even under the permanently altered conditions of money, material, and labour values, the terms of the sliding-scale required revising, considered that the hardships inflicted by the war would have to be borne, and the matter of revision deferred until after the war. Some of them do not think so to-day; they are among the applicants to Parliament for consideration and authorization to take steps, for the period of the war and for such time as may be prescribed after, to do justice to the capital employed, and to save the financial reputation of the gas industry among investors. Permanent revision will have to be a matter for more mature consideration when the conditions can be better gauged.

The subject has been a very live one during the year; and there has been much animated discussion upon it. Into all this we cannot enter in a review. The history of the matter is set out with fullness in articles and letters that have appeared in our columns. Eventually the National Gas Council were prevailed upon to take up the question. The result of the first interview at the Board of Trade was taken to be final. But the position became too grave; and perseverance led to the Council considering the matter with due seriousness. The North of England Association, and particularly Mr. Thomas Waddom and Mr. T. P. Ridley, rendered valuable help in the collection and collating of statistics, which gave the groundwork for the excellent case that a deputation, headed by members of Parliament, Mr. H. E. Jones, the President of the Council, and with Mr. D. Milne Watson, the Chairman of the Executive Committee, as chief spokesman, laid before the President of the Board (Sir Albert Stanley). During the year various meetings of the members of Council were held to discuss the whole matter; and before the deputation went to the Board of Trade, several schemes of relief were examined. Finally it was thought that the simpler the proposal, and the easier its application as a temporary measure, the better would be the chance of acceptance. Therefore, the scheme adopted for submission to the consideration of the Board was that dividends should not be less than their pre-war rates by more than 20 p.ct. of the difference that would result from adherence to the sliding-scale provisions, and that maxi-

mum price companies and local authorities (who will have to go to the Local Government Board) should be allowed an additional 6d. upon maximum prices. The deputation was received very sympathetically by the Board; and there was an evident desire on their part to do what was possible to help the industry in the peculiar circumstances brought about under war conditions by the peace time legislative regulation. Ultimately, the decision of the Board was that they could not promote a Bill which would apply universally, but could only deal with exceptionally hard cases.

Meantime certain companies had decided—this unknown to the Executive Committee of the Council—to proceed with Bills which, among other things, asked for relief in this particular. It was almost at the eleventh hour before notices had to be given of promotions that this became known to the Executive; and thereupon it was hurriedly decided to send out telegrams to a number of companies announcing the new move, and advising that Bills should also be promoted, with the view to the scheme of the Council being placed before the Parliamentary Committees. At the same time, the situation was explained to the Board of Trade, who saw that the hands of the Council had been forced by the movement initiated by the companies who took independent action. Quite a number of companies adopted the suggestion of the Council; and several Bills will claim the attention of Parliament. This is the position to-day; and, whatever the proposals of the independent companies, that all will be going before Parliament with a common cause should have influence in bringing about a definite solution of the to gas capital unfair working of the sliding-scale in this period of extraordinary stress. In our "Correspondence" columns, the point has been made that the position of those companies who do not charge meter-rents should have special consideration.

A notable report appeared in the course of the year by the Massachusetts Board of Gas and Electric Light Commissioners as to the working of the sliding-scale in connection with the Boston Gas Company. The Commissioners could not, after nine-and-a-half years' working of it, see that the Company were doing any better than other concerns that were not under its operation, and therefore they did not speak in any too high commendation of it—in fact, they seemed to care little whether or not the system was completely withdrawn. But it was shown that the actual working of the system is somewhat obscured by the fact that the Company had subsidiary company associations which, it was thought, did not allow the system full swing.

Labour Generally and Particularly.

The cost of coal and of materials and goods, deliveries and inferiority of coal, financial restrictions due to the war, priority certificates for plant and appliances and for repairs and renewals, higher costs of labour, and the injustice to stock and share holders of the sliding-scale, under the circumstances of the times, were not the only subjects of worry. The shrinkage of labour to carry on the work of the industry was another cause of anxiety. There has been a pitched battle almost throughout the year to save to gas undertakings skilled men who are more valuable than unskilled ones, even if the latter could be obtained. Notwithstanding that the Ministry of Munitions were advising that more gas should be used by existing customers for all possible purposes, in order to increase and maintain the output of high explosives and liquid fuel, the War Office continued to struggle for the release of every possible man. It would take columns to write the history of the year in respect of labour in gas-works in all its many phases. There was the work of the Director-General of National Service, the withdrawal of leaving certificates, the debadging of gas men, the continual revision of the certified occupation lists, the revision of age limits in certified occupations, and then came the new Protected Occupations Schedule, which caused no end of alarm among non-certified gas undertakings through the appearance of the word "certified." There were not at the time more than a hundred gas undertakings actually certified; the fact that gas-works engaged in providing benzol and toluol were under the wing of the Explosives Department of the Ministry of Munitions had been considered sufficient. Interpretations, directions, numerous conferences between the Ministry of Munitions and the Executive of the National Gas Council, and many promises and many attempts on the part of the Ministry to obtain an authoritative declaration and to restore composure, ended much in the same way. The old struggle continued with the local tribunals.

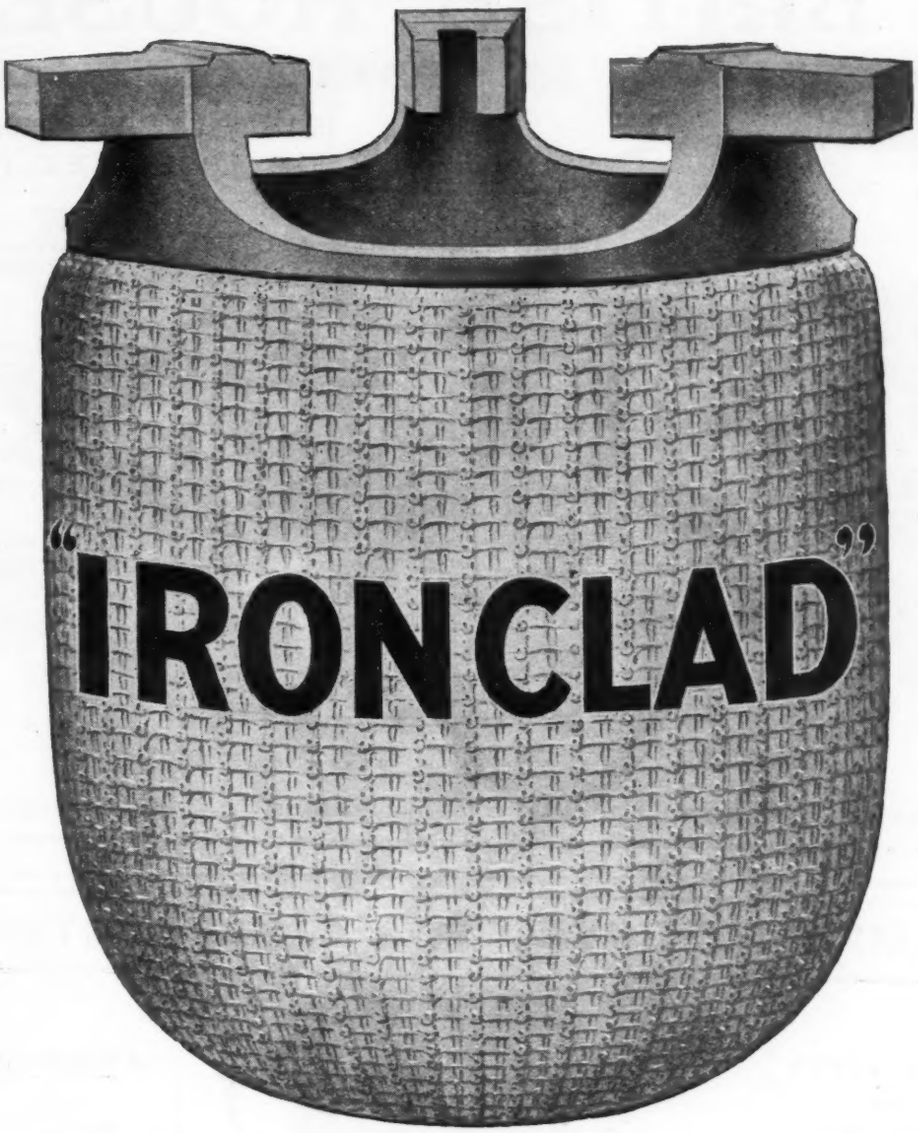
In the summer the National Council had to confess, after all their efforts, that the position was still obscure and difficult. They also stated that one thing was plain, that it was necessary to apply for certification in order to come under the schedule, although numbers of undertakings that were not certified or were not eligible for certification were being dealt with and protected by the Munitions' Area Recruiting officers. But in practice this was not always found to be the case. The position towards the end of the year was described by the Executive Committee of the Council. Further appeal, had been made by them to the Ministry of Munitions on behalf of all gas undertakings that, not being certified, were excluded from the provisions of the Schedule of Protected Occupations. It had, however, been found that many works undertakings not so certified were being treated under the schedule, and that the cases which were not so treated had either neglected to apply for protection, or were being refused on some local or individual grounds. The Committee had, however, brought many of these latter cases to the notice of the Ministry with satisfactory results, where it was shown that the undertaking is engaged on work for the Admiralty, War Office, or in connection with munitions. The question of the advantages and disadvantages of certification was considered in an editorial article last week.

The advice was constantly given to gas undertakings that in every conceivable occupation in which women could be employed, they should be, in order to relieve men. There has been real patriotism shown in this respect by many gas undertakings; others evinced more reluctance in making substitution. But it is a most remarkable feature of the "wo-manning" of gas undertakings to-day that women are to be found in almost every branch of the business and work—even one of the retort-houses of the Vauxhall works of the South Metropolitan Gas Company is operated entirely by them—and well the women are doing a great and good work. But the demand for their labour everywhere, and the wages that can be earned by them, make it difficult now to get suitable women for gas work, especially strong women who can undertake the more arduous duties.

With the approach of winter, anxiety as to labour again became intense; and the position was critical. Works found themselves with summer staffs for the winter pressure, and, under such conditions, an impossible task faced many undertakings. Hope, however, came from the Ministry of Munitions, who announced that, in certain circumstances, men would be released from His Majesty's Forces for temporary re-employment during the winter.

Gas companies have had comparatively little open trouble over the war bonus question; in their case the increasing costs of living have been promptly met by advances of the war bonus. What was done by the Government in respect of the railwaymen set the pace in the early part of the year. A second advance was then conceded to them; and only just recently they have had a third advance by 6s. for men, 3s. for youths under 18 and women, and 5s. for men working in railway shops. Where gas companies have had difficulty has been in the cases of certified and controlled undertakings, over the 12½ p.ct. increase to skilled engineers and moulders in munition works. A good deal of trouble was experienced in connection with some municipal gas undertakings; and in several instances there was recourse to arbitration. But the decisions have not in all instances pleased the men. In a few cases, there were strikes of short duration.

There has been a large amount of unrest in the different sections of industry—particularly among munition workers; and there are labour leaders who attribute this to a want of co-ordination in the numerous Government Departments in connection with their dealings with labour. There have been strikes of engineering men in munition works, of thousands of workers on aeroplane production at Coventry, and in other fields of employment the opportunity has been taken to press for, and to obtain, concessions in this period of emergency and crisis—among other things the recognition of the new creation, the shop steward. Certain sections of labour have not by their actions been placed in the most favourable light, many of which actions have not received the sanction of the Union leaders. Were it not that these troubles were occasioned by sections only of workers, who delayed, and knew they were delaying, the output of first necessaries for the war, we should have very profound doubts as to the well-meant plans for better co-operation



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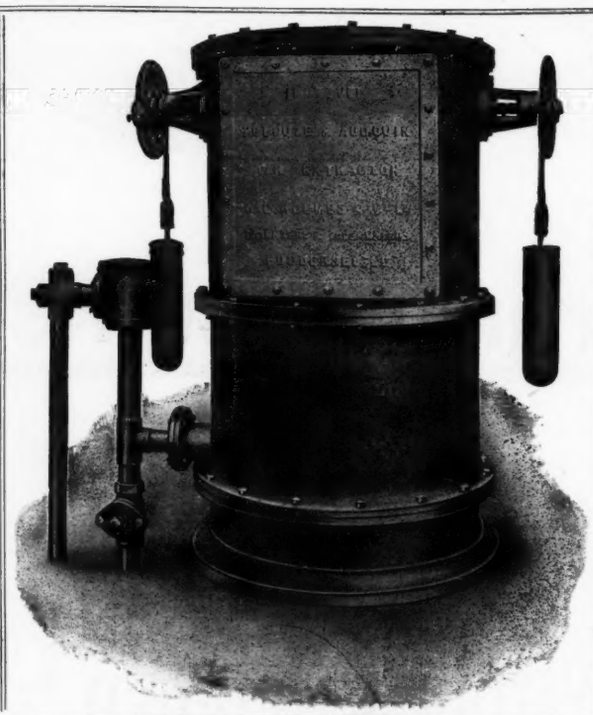

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between employers and employed in the period of reconstruction after the war—such schemes as the National Alliance of Employers and Employed and the Joint Standing Industrial Councils.

During the year the co-partnership scheme has been put to a very severe test. Being founded on a sliding-scale of gas prices, and gas prices having soared to extraordinary heights, the title to bonus has in some cases disappeared. But, *per contra*, there have been heavy obligations upon the companies in distributing among their workers war bonuses in consideration of the higher cost of living. Moreover, those fortunate employee co-partners who have stock holdings in the companies continue to receive dividends, albeit reduced ones, in association with all other stockholders. In most cases co-partners, being men of intelligence, have realized that the operation of the scheme to their temporary disadvantage is of the fortunes of war, and that at the institution of the scheme they took the risk of it working up and down—never expecting that it would always, in all circumstances, go upwards, and never expecting that there would be such a war that would send costs flying to the extremes under which the industry is now labouring. The Directors of the Bournemouth and the Croydon Companies, in their sympathy with the men, came to the conclusion—seeing that the events that had caused the elimination of the bonus were not of the making of the men, and were altogether exceptional—to institute a minimum bonus of 4 p.ct., and accompanying this a definite pension scheme which is now indirectly a part of their co-partnership systems, as a certain proportion of the charge comes on to the bonus. In his Presidential Address to the Institution of Gas Engineers in June, Mr. A. E. Broadberry, from his experience, questioned the bonding influence of co-partnership in times of stress such as these, and with the temptations of the higher wages of munition works dangling before the men. He suggested that the co-partnership scheme required a pendant in the shape of a pension scheme, the general lines of which he described. A good deal of useful work was done by gas undertakings in connection with war loan and savings schemes.

The Council of the Institution during the year took a large active part in discussions and work connected with the heavy reduction of the industry's man power. One very useful piece of work is the establishment of a Demobilization Committee for the purpose of assisting members of the gas industry of all grades who have joined His Majesty's forces to return to their old positions after the war. Of this Committee Mr. R. G. Shadbolt is the Chairman.

The Workmen's Compensation (War Addition) Act came into operation on Sept. 1. It provides for an addition during the war, and for a period of six months thereafter, to the amount of the compensation payable in cases of total incapacity under the Workmen's Compensation Act, 1906.

Priority Certificates, &c.

The gas industry has shown a large patriotism; and it has not boasted of the cost of so doing. But it has been felt that, while the Government have asked as much as possible from the industry, and has pressed for more and more, as little as could be has been done for the industry in return. We all recognize the difficulties of the Government; but we look, on the one hand, upon the work of the industry for the Government, and, on the other hand, upon the conditions in regard to coal, the controlled prices for residuals, the limitations as to exports, the financial situation, and the nakedness of the industry in respect of man power. Upon all of this come the orders and permits as to dealings, and the question of priority certificates for plant, meters, stoves, &c. A goodly volume of official communications is now filed away by gas undertakings, and, if preserved, will form a monumental record of the difficulties of the industry in these times. The Government, of course, want huge supplies of metal, and of labour for dealing with it. At the same time, the gas industry is indispensable to the manufacture of war materials and the provision of a sufficiency of high explosives; and therefore it should, if its efficiency for these purposes is to be maintained, receive as much consideration as is possible—at any rate, consideration superior to industries of less importance in war service. The industry does not expect anything unreasonable; but it has felt that all that might have been done has not been done in regard (for example) to plant renewals, especially of the labour-saving variety. As recently as November last, the Executive Committee of the National Gas Council announced their intention of again taking up the question with the Ministry of Munitions, on the ground that, if the important work for the Government which is being carried out by gas undertakings is to be continued, and the supply of gas maintained, drastic measures are necessary to ensure that renewals and extensions of plant shall be effected. In regard to priority for the renewal and repair of meters and stoves, the Priority Branch of the Ministry of Munitions decided to ration available material among the makers for repairs, replacement, and a limited number of new appliances. The first period of the rationing was fixed for three months from Nov. 1. In respect of rationing for meter repairs, some doubt arose, and a plain interpretation was obtained from Dr. Hazell, of the Priority Branch of the Ministry. It was published in our issue for Dec. 4 (p. 465).

Trading Features.

In all that has preceded in this retrospect, we have endeavoured to do two things—to show in broad outline how the year has disclosed, or defined with greater clearness, important roads along which the industry can and will make progress both technically and commercially, and to emphasize the several factors—products of the war—that have influenced for good or ill the working of the industry and the financial issues. Certain it is that we shall not again return to the conditions that preceded the war—either internally or externally; and therefore the lessons of war time must be followed up with diligence. Coal, oil, materials, goods, and labour will be dearer, capital more expensive, and taxation heavier than in pre-war times. By some means, these adverse conditions have to be compensated. What has been sketched here helps to point the way. But we are anticipating from the indications of the year; and there are a few points to be made concerning the year's experiences.

In February, the Governor of the Gas Light Company (Mr. John Miles) stated that, since the beginning of the war, coal had advanced in price 50 p.ct., coal freights 400 p.c., and oil, including freights, 300 p.ct. Those gas undertakings that are near their coal supplies had an advantage in the matter of coals over those more remotely situated. An experience that was almost general was the considerable increase in the consumption of gas—due (as already stated) to the several degrees of frost that were experienced for protracted periods in the early part of the year, to industrial demand, to the appeal to existing consumers to use more gas instead of solid fuel, and to the difficulty of obtaining deliveries of household coal. Many undertakings in January and February had average increases of from 20 to 30 p.ct.; and the average of the first half year showed increases of varying amounts, but mostly somewhere between 10 and 20 p.ct. In the second half year, there was a very fair amount of hot weather, and the Summer Time Act was in operation from Easter Sunday (April 8) to Sept. 23. But in November and intermittently in December, cold weather again came; and no doubt, combined with the situation in relation to coal, it will be found that the second half also netted its increase for most gas undertakings. Some have had increases that have far more than compensated for the reductions caused by the restrictions upon lighting imposed by the authorities. In some instances there have had, through the combination of difficulty in meeting any accretion of consumption, to be requests to consumers to exercise economy in the use of gas. There have been two or three instances in which reductions of price have been made. These have a unique place among the crowd of further advances of price, with certain additional increases from next month owing to the higher expense of both coal and labour. These additions to price (the Gas Light and Coke Company have had to go up to 3s. 10d. and the South Metropolitan Company to 3s. 7d.) have had a very bad effect, as already seen, upon dividends; and the conditions of balances forward and reserve funds proclaim the efforts made to stave-off increases of price as long as possible.

An effect of the increases of price has been seen in our "Stock Market Report." If the figures in the first issue of the "JOURNAL" for this year are compared with those in the last issue, it will be seen that the prices of most of the stocks have given way somewhat. Two home ones, however, have had a heavy fall—Hastings and St. Leonards and Portsea Island. Among concerns that operate abroad, an improvement has been marked in Imperial Continental, Continental Union, and Cape Town.

Local authorities owning gas-works, too, have found the increases of price they have made insufficient to maintain the earnings at the level that the profit takers in aid of the rates would like to see them at. The Manchester Gas Committee, for instance, reported their opinion that it would be impossible to contribute anything in relief of the rates in the current financial year. Even without allowing for a contribution, and with the present price of gas, a big deficit is anticipated after making full provision for renewals and sinking fund. The Committee consequently had no alternative but to raise the price 6d. per 1000 c.ft. In connection with the appointment of a Trading Profits Sub-Committee of the Manchester Corporation, Mr. F. A. Price, the Superintendent of the Gas Department, suggested that, as the outstanding mortgage debt on the works was secured on the rates, the amount of such debt was the true and proper factor upon which to base contributions, if any, to the rates. He considered that the precedent for 1 p.ct. on the outstanding debt well met the case. If this principle were adopted in the case of Manchester, nearly £40,000 would be saved to the gas consumers. The shortage of profits was a matter of much heart-burning in other municipal quarters. The gas undertakings of Ireland have been very hard hit in the matter of costs; and two or three of them have obtained sanction to increases of their maximum prices—Lisburn, for example, from 4s. to 6s. There is very little in the way of "excess profits" to be found in the gas industry to-day. A notable feature is the growing favour of the annual meeting for gas companies in place of the half-yearly one. Some of the companies with power to issue redeemable stock, and with Treasury sanction, have done so this year—a prominent instance being the South Metropolitan Gas Company's issue of £250,000 of 5 p.ct. stock. Despite all the difficulty of the year, there have only had to be recorded three or four failures of gas supply, and these with two exceptions due to accident that could not be foreseen. But more than that number of works have been close to running out, owing to the depletion of coal stocks, and in certain instances shortage of labour with heavy gas demand.

In this country the gas and electricity consumers have not had their supplies controlled as has been the case in Germany, France, Holland, and possibly elsewhere. In Germany and Austria especially, coal, labour, and transit conditions have compelled very drastic curtailments; and some gas-works have found it necessary to discontinue the supply during certain hours of the day. We cannot now go into the details of the restrictions upon gas consumption in Germany. But, as our columns have shown, they were severe, and the penalties attaching to default were of a like order. The Chairman of the Board of the Imperial Continental Gas Association (Sir Charles J. Jessel, Bart.) reported at the meeting in May that the Board had submitted total claims against the Central Powers amounting to £15,713,000, to which there will be something to add for the period succeeding the date to which this sum was calculated. Invitations were issued by the German Government authorities for the purchase of the Association's interests in Berlin; and recently it was reported from Amsterdam that a sale had been effected of part of the works for the sum of £4,250,000.

Gas undertakings in allied and other countries abroad that have to depend upon British coal have suffered very severely by the shortage of coal and the price delivered, though the charges from port to works the other side are by no means light. More distant undertakings (those in South America particularly) have had an extremely rough time through the coal supply difficulty, combined with which in the case of the Primitiva Company was the conduct of the Municipality—in relation to their debt to the Company, which filled the cup of trouble for the latter to more than overflowing. But at the last meeting there were hopeful signs that the Municipality would be liquidating a part at all events of the debt. Fortunate were the companies in India and at the Cape who were able to satisfy their coal requirements locally. Through this change to local coal the undertakings at the Cape had their financial position greatly improved. In many places abroad other materials than coal were employed in part for gas-making purposes; and their use and the trials will make an interesting contribution to the efforts of gas engineers to ameliorate the war-time conditions. The Bombay and Oriental Companies did well; the Australian Gas Company had to pass their dividend for the half year to June, as, in consequence of the provisions of the Gas Act of 1912, it was impossible to obtain further necessary capital. The Metropolitan of Melbourne Company were not driven to such an extremity; but coal and labour troubles in Australia did not improve the position of the largest gas companies there, although some considerable additions to business were registered.

RESEARCH AND THE FUTURE.

Let us turn for the moment from things commercial to movements of great significance. It has been seen that the gas industry is standing at the gates to broader ways to service, and that it will have a greater place in the country's and the world's affairs than ever it has occupied before. It offers through its processes, and the possibilities that are seen, work of considerable and ever-increasing magnitude to chemists and physicists; and it is to them that we now look for much through research. Engineers and those who manufacture the industry's plant and appliances will develop their respective sides of the work in the light of the disclosures of that research. Among chemists there has been an awakening of interest in coal-carbonizing processes. They see in them a field of great fertility. From every standpoint, it is clear that the gas industry is going to take a good part in the work of reconstruction and industrial revival and expansion, about which so much has been heard during the year. For this, there have been schemes innumerable put forward—good, bad, and indifferent; and the organizations are many that have had birth in view of the good time soon coming. Among the number is a Union of Manufacturers; and the gas industry is found represented in it. There is the Chemical Manufacturers' Association, with objects of a far-reaching order; and associated with it are Mr. Charles Carpenter, D.Sc., and Mr. D. Milne Watson, the Chairman of the Executive Committee of the National Gas Council. The Ministry of Reconstruction has invited the Association to co-operate with him in preparing to deal with the chemical problems that will arise after the war. For the purpose an advisory body has been appointed by the Association. Our pages have illustrated during the year, through the large amount of matter that has appeared in them touching chemical work in the industry, the developments that are taking place in this direction, and what there is in store.

The Government are doing their share in the work of research and the application of science to industry. Their estimates for 1917-18 in respect of education, science, and art increased very substantially. The rise is accounted for almost entirely by the new grant of a million pounds in aid of scientific and industrial research. Grants are being made by the Privy Council Committee on Scientific and Industrial Research to approved trade associations, for investigation carried out by learned and scientific societies, and to students and others engaged on research. In the second report of the Committee it is indicated that it is hoped to accomplish much through the trade research associations; but, where their co-operation is impossible, it is proposed to take a different course. Fuel is an excellent illustration of this. Hence the establishment of the Board of Fuel Research, with Sir George Beilby, F.R.S., as Director, and Prof. W. A. Bone, F.R.S., occupying the position of expert adviser. From the labours of the Board the gas industry is hoping for much contributing to the development of its work. The report which the Board recently issued showed that their programme is cast on broad lines, and that they are not prepared to take for granted anything that, in their expert judgment, is not incontestably proved. This was seen by their remarks on low temperature carbonization, and upon the plausible ideas that have obtained currency in the electricity industry as to the amalgamation of coal carbonizing systems with the electricity generation processes. Fuel economy suggests that the preferable course will be amalgamation with established interests dealing with the carbonization of coal and the products arising therefrom. National economy in this respect has to be considered as a whole, and not from any individual industrial standpoint. For the work of the Board a complete research station is to be constructed at the East Greenwich works of the South Metropolitan Gas Company, the Chairman and Directors of which have very generously offered site and facilities of which the Board have gladly availed themselves. It has already been mentioned that to the Board the question of gas composition has been referred, and that the Joint Gas Investigation Committee of the Leeds University and the Institution of Gas Engineers will be reporting to the Board on the subject.

Relating to the work of the Board, the Coal Conservation Committee, and the Board of Trade Committee on the provision of a cheap supply of electric power, the National Gas Council appointed a Committee, some references to whose work appeared in the report of the Executive Committee as published in the JOURNAL for Nov. 6 (p. 258). Another body in which the gas industry should have interest is the Committee that the Minister of Reconstruction has appointed on the supplies of materials after the war.

MISCELLANEOUS MEMORANDA.

Other matters that usually have notice in the retrospect must be omitted on this occasion, owing to the length to which it has been necessary to go in order to give even a mere outline of those subjects which, combined, show the internal position and the prospects of the industry as seen from the new platform that has been created. Therefore let us briefly say in these closing notes that those who desire a review of the gas legislative work of the session will find it in articles published in the "JOURNAL" for Oct. 16 and 23; and one dealing with the notices of Bills for the coming session was given in our issue for Nov. 27. In our "Legal Intelligence" the case of the year of most general importance is the Hackney preferential charges case, in which the decision went against the Gas Light and Coke Company in both the First and the Appeal Courts. We will only point to one other case, which shows that neglect of the requests of the Ministry of Munitions may receive salutary punishment, as the Longridge Gas Company are now aware.

In regard to works, we ought to notice the bringing into use of the 12¾ million cubic feet holder at the Mortlake Station of the Australian Gas Light Company. Refractory materials have had a large amount of attention bestowed upon them in the course of the year; and an account of further researches on purifier efficiency was published in the report of the Chief Inspector under the Alkali Works Regulation Act.

Some extraordinary accidents occurred in which gas-works were involved. Early in the year an explosion at an East London Chemical factory crippled a 12 million c.ft. gasholder, and caused the loss of close upon 8 million c.ft. of gas. In the summer an explosion at a munition works resulted in the wrecking of two holders at the Ashton-under-Lyne Gas-Works; and gasholders at Dukinfield were also damaged. In August, there was an explosion at the Grimesthorpe works of the Sheffield Gas Company, which caused damage to the station meter-house, the roof of the exhauster house, the iron store, and blacksmiths' shops, and to one or more lifts of a telescopic holder. The drum of one of the station meters was under repair at the time.

An event of both interest and importance to the gas profession, and indeed to the industry generally, was the election of Mr. H. E. Jones to the Presidential Chair of the Institution of Civil Engineers; and for a second year he has been elected President of the National Gas Council. Speaking of the latter body allows of note being made of the formation of the Scottish Gas Council, who, while fully acknowledging the supremacy of the national body, will keep under close surveillance Scottish gas affairs. Lord Moulton has succeeded Mr. A. E. Broadberry as President of the Institution of Gas Engineers. The question of a home for the gas industry was revived, but was soon laid aside for some more convenient season, for well-known reasons. Sir Hallewell Rogers continues in the presidency of the British Commercial Gas Association; while Sir Robert A. Hadfield, F.R.S., D.Sc., is now in the Presidential Chair of the Society of British Gas Industries. Details of the work of these organizations, of the Gas Companies Protection Association, and of the other bodies whose proceedings we report, must be passed over.

As our indices will readily show, the lists of official changes, of retirements, and of honours are long ones this year; and so is that of the names of those who have "passed hence"—many fighting for their country, for honour, and for justice. We pause from our work to do silent homage to them.

The tide flows onwards; and we with it. There is much work to be done now and after the war; and we must brace ourselves up for it, with the prayer on our lips that the terrible world catastrophe may soon end in victory for truth and justice, and an enduring peace.

The Hackney Preference Case.

Judgment in the Appeal Court in this case has, as in the Lower Court, gone against the Gas Light and Coke Company; their Lordships putting the point at issue in an entirely different category from that raised by the Long Eaton case, the decision in which they thoroughly endorsed. Owing to the publication of the "Retrospect" this week, comment upon the judgment must be deferred until our next issue.

A Bank of Industry.

An interesting proposal in connection with industrial banking is described in a report which has been issued by the Committee on Banking of the British Empire Producers' Organization, of Kingsway House, W.C. The general idea of the scheme is to afford readier financial support on sound principles, throughout the United Kingdom and the Dominions and Colonies, for producers and manufacturers "of British origin, and whose registration is within the British Empire." There is no intention of departing from methods which have been successfully demonstrated on a national scale, or of conflicting in any way with the ordinary joint-stock banks. The idea is that capital shall be provided by the issue of debentures, by deposits with a State guarantee, and by the funding of profits. The suggested amount of the guaranteed capital (to be enlarged as the need arises) is £50,000,000; the guarantors being, in regard to one-half, the United Kingdom, and in respect of the other half the Dominions and Colonies. There will be no disagreement with the objects for the attainment of which the proposal has been formulated. The Empire's producing and manufacturing industries will need all the encouragement they can get, if the very best is to be made of the opportunities of the future; the best method of rendering this assistance is the only matter that can be in doubt.

GAS FOR MOTOR VEHICLES.

Use for Essential Purposes Only.

THE Board of Trade announce that, with the concurrence of the Petroleum Executive, it has been decided that the use of gas for motor vehicles is to be brought under the same regulations and restrictions as the use of motor spirit. It is stated that the reasons for this step are the serious position resulting from the deficiency of tonnage, and the probability that circumstances may at any time arise which will require a further reduction of the supplies of petrol available for civilian purposes, and the urgent necessity of reducing to the absolute minimum the expenditure of labour and materials for other than war purposes. Its object is to provide that, to the extent that gas may be available, it shall be used only for essential needs in substitution for petrol, with the object of reducing the consumption of the latter wherever practicable and of conserving stocks.

It is recognized, says "The Times," that a certain number of vehicles have already been fitted for the use of gas; and, wherever possible, permits will be granted in these cases to enable such vehicles to be used for essential purposes, as indicated by the Motor Restriction Order. It is not intended to prohibit the use of gas for motor vehicles in so far as, subject to other considerations, it may be available, nor to license the quantity that may be purchased, but only to confine its use to the purposes stated. The best methods of the adaptation of gas for driving motor vehicles and questions relating to the safeguards against any danger attending its use are the subject of investigation by Mr. Walter Long's Committee on Gas Traction.

It is proposed to issue shortly a new Order consolidating and amending the present Motor Spirit Restriction Orders; and the regulation of gas will be dealt with in the new Order.

Connecting Services to Mains Under Pressure.—Mr. L. B. Benson, of Bartlettsville (Oka.), in the "Gas Men's Wrinkles," issued by the National Gas Association of America, suggests a simple method of attaching a service to a main under pressure, which dispenses with the use of a saddle, even with wrought-iron or steel pipe. A socket of the required size is fixed in position (by acetylene welding), into which an ordinary cramp drill can be introduced, and the hole bored through inside the socket.

Masonic.—On the 18th inst., the Murdoch Lodge, No. 3480, met as usual in Birmingham, under the mastership of W. Bro. Harold G. Eveson. The S. W., W. Bro. Luke B. Taylor, was unanimously elected Master of the Lodge for 1918. He was a founder of the lodge, as also of the Northern Star Lodge, No. 3053, and a P.M. of Lodge No. 347. For many years he has been the senior representative of the firm of J. & J. Braddock, Ltd., of Oldham.——At the annual meeting of the St. John's Lodge of Mark Master Masons (T.I.), held at Bolton last Thursday week, W. Bro. Joseph Taylor was installed as W. M. for the ensuing twelve months.

PERSONAL.

At a meeting of the Institution of Civil Engineers on the 4th inst., the election as Associate Members was reported of Mr. GEORGE R. ANDERSON, B.Sc. (Eng.), of the Tipperary Gas-Works, and Lieutenant RONALD B. GLOVER, R.E., of St. Helens; and as an Associate, of Mr. HORACE M. THORNTON.

Mr. KENNETH D. HANDEL, son of Mr. T. Handel (the Manager and Secretary to the Ilminster Gas Company), who has seen active service in France, during which he was wounded, has been promoted to Commissioned rank in the Royal Flying Corps. Before joining-up, he acted as assistant to his father.

At the meeting of the Yorkshire Section of the Society of Chemical Industry at Leeds, on Monday of last week, papers were read by Mr. A. Edwards, on "The Approximate Estimation of Tar Fog in Gas" and "Apparatus for the Determination of Boiling-Points." Prof. J. W. Cobb (the Chairman) presided.

At the monthly meeting of the Hebden Bridge and Mytholmroyd Gas Board, it was reported that, at a special meeting, the salary of Mr. T. H. NIELD, the Manager, had been advanced to £300 per annum from Oct. 1, and that he was to have further advances of £25 on Jan. 1 and July 1—making his salary £350 from that date.

Mr. J. R. BRADSHAW, who has been appointed to succeed the late Mr. J. B. Fenwick as Gas and Water Engineer to the Retford Corporation, has lately been acting as the Chief Assistant to Mr. F. Chadderton, at Barrow-in-Furness. He was articled to Mr. Charles Harrison, at Accrington, and was then for some years with Mr. Robert Watson, at Doncaster.

Mr. JAMES SIMPSON, J.P., has tendered the resignation of his position on the Hebden Bridge and Mytholmroyd Gas Board, on which he has sat continuously since its formation 23 years ago. It has been decided to record his services in the minute-book. For sixteen years Mr. Simpson has been Chairman of the Board. During his period of office, the consumption of gas has increased from 44 to 104 million c.ft. per annum.

ELECTRICITY SUPPLY MEMORANDA.

THE Institution of Electrical Engineers two or three weeks before Christmas Day once more turned their attention to electric cooking; this time to installations for restaurants and staff kitchens. And the Institution improved the occasion by getting a few users of electric cooking apparatus to come along, and say they were satisfied. Shoals of satisfied consumers of gas for cooking could be obtained, and of satisfied consumers of food cooked by gas. But this is unnecessary. The paper was read by Mr. W. A. Gillott, who hails from Newcastle-on-Tyne, where very attractive terms for electrical energy are offered for cooking purposes—so attractive that we do not remember to have ever seen them disclosed (say) for installation "A" mentioned in the paper. However, a correspondent who was at the meeting, writing to us about Mr. Gillott's paper, does not think that much can be extracted from it which will be very useful to the electrical engineer in search of business for the large type of cooking installation. The author is candid. He started straight off with the admission that "favourable" tariffs are essential to make a sound commercial proposition for large kitchens. Just so. If gas was sold for cooking at one-eighth to one-tenth the cost of gas for lighting, that would be a "favourable" tariff, as electricians would have good cause to know. As a matter of fact, we are told by one gas engineer that, by gasifying coal completely, and properly looking after the secondary products, he has a process by which gas is going to be produced at 6d.—perhaps 3d. per 1000 c.ft. We are not putting this forward as being exactly realizable until we know something more about the system. Anyway that B.Th.U. supplied by gas undertakings are going to be much cheaper for all heating purposes, there can to-day be no shadow of doubt. To that position electricians with their 3420 B.Th.U. per unit of energy must look forward when talking of the prospects of electrical cooking and heating. Great points, of course, for restaurants and hotels are reliability and quickness of service. Mr. Gillott says electricity for cooking is found to be reliable, efficient, and economical. We have just touched on the question of economy, and have indicated that, so far as we have seen from the reports of the paper, Mr. Gillott did not give away anything as to running costs. But in the discussion he stated that electricity at ¾d. per unit could compete with gas at 2s. per 1000 c.ft. That is to say, 3420 B.Th.U. supplied electrically for ¾d. can compete with upwards of 15,000 B.Th.U. supplied for ¾d. by gas! There must be more corroboration than the *ipse dixit* of Mr. Gillott before anyone outside an asylum—excluding, perhaps, electrical engineers—will swallow his assertion.

Large Cooking Operations.

Then as to reliability. In restaurant "A," the apparatus has only been in use ten months; and the consumption of current has been 122,052 units. The cost of maintenance has been 1s. 6½d. per 1000 units consumed, which means £9 8s. 1d. to be tacked on to the running costs for the first ten months, with new apparatus! In the case of "B" kitchen, the apparatus in which has been running for only a year, the consumption has been 97,140 units, and the maintenance costs average 2s. 9d. per 1000 units. In the case of "C" kitchen, with apparatus also boasting a year's career, the consumption has been 21,141 units, and the cost of maintenance 3s. 9½d. per 1000 units. In the case of "D" kitchen (with the same life), the consumption has been 20,690 units; and the maintenance cost 4s. 6½d. per 1000 units. It is stated that the apparatus in kitchen "D," has been catering for an increase of 100 p.ct. more people than was intended, which shows that, while the apparatus has done the work, it was incapable of properly standing the strain. There is an interesting table which should be given in this connection, to show the causes resulting in these charges for maintenance:

Reliability and Other Points.

Installation.	Oven.	Elements.					Vegetable Steamer.	Wiring Faults.	Earthing Faults, Terminals, &c.
		Hot Plate.	Grill.	Urn.	Hot Cupboard.	Fish Fryer.			
"A"	4	2	7	..	..	..	..	17	4
"B"	20	16	25	5	2	3	7	27	25
"C"	..	22	1	1	..	..	..	14	3
"D"	2	28	28	..	..	..	..	17	2

Remember these figures are for only ten months in one case, and a year in the others. As the appliances advance in months—we will not say years—more troubles and still higher maintenance costs may be anticipated; for ten months and a year are short periods to have to talk about such items for maintenance as those quoted. In face of the figures, Mr. Gillott asserts the reliability of electric cooking apparatus for large kitchens! With his figures presented to them, large hotel proprietors and other big caterers would hesitate to trust their businesses and reputations to cooking apparatus possessing so many seats of uncertainty. Mr. Gillott also gave comparative costs of installation, which showed that the electrical was much heavier than gas; but no information was supplied in the abstracts we have seen as to how far the electrical and the gas installations harmonized in capacity. Mr. Gillott has something to say about gas "fumes." We should like him to give a chemical description of the "fumes" from an open burning bunsen flame. He also mentioned the sorely-tried subject of meat shrinkage, without saying whether he referred to equal temperatures and the same duration of cooking. And he advised that, where large quantities of water are required, the temperature should be raised in coke-boilers to 160°, and then the water transferred to electric urns to finish off the heating. He did not explain why those who require hot water should go in for this double operation, when it would be cheaper to raise the water to the temperature needed in one operation in the coke-boiler. However, we can guess the true explanation.

"Exit Gas-Heating."

One of the members of the staff of the "Electrical Review" picked up his scissors, and snipping a paragraph out of the "Daily Chronicle," pasted it down for the printers. Whether or not the original was headed "Exit Gas Heating," we do not know; but the paragraph with this side heading was published in the "Review." Knowing of 40 and 50 p.ct. variations in the output of gas caused by domestic gas heating through heavy falls in temperature one day compared with another, we wondered what this "exit" meant, and found that it simply amounted to the abandonment of the use of flueless gas radiators—not ventilated gas-fires—in what was obviously a very imperfectly ventilated place; otherwise the conditions that were found by an analysis of the atmosphere would not have existed. If, in the Southwark Coroner's Court, a flueless coal grate had been used, some day Dr. Waldo (the Coroner), his jury, and the other unfortunates who had occasion to attend his Court might have required the services of a coroner themselves. It seems that Mr. J. H. Coste, the Chemist to the London County Council, analyzed the air of the Court, and found that the gas radiators had loaded it with ten times the normal amount of carbon dioxide, and gave off an irritant gas as well as aqueous vapour. This suggests that the radiators were of the flueless type; and it confirms the assertion that the place was badly ventilated, and therefore it was not the most healthy for the purpose to which it is put. It would be interesting to know if the conditions under which Mr. Coste made his tests assured that the whole of the carbon dioxide came from the radiators. Certainly the entire quantity present in the air does not come from this single source when inquiries are being held; and the cubic foot or so of carbon dioxide that is thrown off per hour by each individual in the court is impure, while the carbon dioxide from the combustion of gas is not contaminated. When Dr. Waldo finds the place does not agree with him is when he and others are contributing to the carbon dioxide in the air; and even now, with an electric stove in use, we would suggest that he should look after the ventilation. Had a gas-fire been adopted, connected with a flue, it would have contributed to the ventilation of the Court, and so have kept the atmosphere in a purer state than the expensively running electric-stove, which does nothing to aid ventilation, and, unless a voracious consumer of current, cannot be a very effective heater with only 3420 B.Th.U. available

per Kilowatt-hour, and electric fires have not a thermal efficiency of 100 p.ct.

Some Authorities. We can quote several authorities to show that pure carbon dioxide is not, though the proportion may be high, harmful to human beings. Pettenkofer, for instance, puts its harmlessness at 100 parts per 10,000 parts. Dr. Angus Smith found that though, in a closed chamber, the carbon dioxide reached a point at which a candle was extinguished, he himself experienced no ill-effects. Dr. Leonard Hill and Dr. Flack have kept students in a closed chamber until the carbon dioxide reached 3 and 4 p.ct., and the oxygen had fallen to 17 or 16 p.ct.; and they experienced no discomfort. The same authorities point out that, whatever the percentage of carbon dioxide in the atmosphere may be, that in the pulmonary air is kept constant at about 5 p.ct. of an atmosphere by the action of the respiratory centre. If Dr. Waldo wants to know something about the effect of carbon dioxide on human beings, he should go and examine some of the healthy specimens in breweries and aerated water factories. With perfect combustion of gas, and an open bunsen flame, there will be no toxic compounds formed; and as to aqueous vapour, well there is nothing nocuous there. The most sanitary system of heating is the gas-fire with a flue in view of its ventilating properties; and the rate of the entrance of such fires into daily use has proved their popularity. It is a pity that in the "Daily Chronicle" report (perhaps some electrical engineer inspired it) there was not a little more candour; but then perhaps the "Electrical Review" would have been less pleased.

A Christmas Warning. Our electrical contemporary in the same issue announces that the British Fire Prevention Committee have issued a special warning in connection with Christmas entertainments in hospitals, camps, private assemblies, &c. The danger of the ignition of dry evergreens, Christmas trees, paper lanterns, cotton wool, celluloid, &c., is pointed out; and the public are warned not to make the slightest change in electric wiring without consulting a competent electrician or an electrical inspector. The warning is a very essential one. There have been some ugly disasters at Christmas time through defective electric wiring and short-circuiting. Dr. Waldo, as Fire Coroner in the City, knows something about fires electrically caused. The Fire Prevention Committee advises that buckets of water should always be available, while stout blankets are useful for smothering incipient fires. The very presence of buckets of water and stout blankets would be enough to spoil the enjoyment of some sensitive people.

The Guarantee Scheme under Criticism. Last week reference was made to the electric-wiring guarantee scheme which the Electrical Contractors' Association have adopted, and to carry out which they have established N.E.C.T.A., Ltd. Already there is criticism as to the insufficiency of the scheme, and a partial defence of it by "Audion" in "Electrical Industries." The scheme only covers the smaller installations; and the guarantee merely extends over a period while the installation is perfectly new. Therefore, large installations will not be touched; and time is not given for the maturing of defects, owing to the use of materials of indifferent quality. Fires and disturbances of supply are known to have occurred in large buildings where the work has been carried out by firms of tip-top position; and in such places installations are more hard-pressed than in the more peaceful domestic domain, although in the latter troubles are by no means unknown. A friend of the writer's recently had five failures of his wiring, and as many metal filament lamps went within a fortnight; and the bill for repairs three times within a fortnight has not brought the blessings of the householder upon this particular electrical installation. But this by the way. It seems that the limit of liability under the scheme is fixed at £50 in respect of any one client. The criticism that has been made of this is that the amount is sufficient, no doubt, in the case of the smaller class of installation, but would be entirely insufficient where the work is of any magnitude. But "Audion" answers that the small jobs are the ones that are most numerous; and they are the ones in respect of which the guarantee is most needed. For reasons already stated, we are not altogether so sure of this. The proof of the pudding is in the eating; and the proof of the electrical installation is in its working under the conditions of its own particular service. "Audion," in connection with large installations, points to the firms of high reputation, to elaborate specifications, and to engineers at hand to see that the work is carried out in every detail. Even so, there is not immunity from trouble; and there are Government buildings that can attest this. We do not suggest that these troubles are alone due to indifferent work. The limit of the guarantee to six months seems to be a more serious matter. The critic says that defects due to bad material do not show up in the first six months. "Audion" replies that this is quite true; but it is no less true that the guarantee relates to the manner in which the work is carried out—not to the perfection of the materials after prolonged daily use. The expression "prolonged" is hardly a legitimate one to use in relation to six months; and "Audion's" remark would seem to indicate that the quality of the materials used will not come within the inspection and the guarantee, but only the "manner" of executing the work. We can hardly think the Electrical Contractors' Association intend to spoil their scheme by any such limitation, though the short-period guarantee does not disclose, in any conspicuous way, the existence of a "prolonged" confidence in any installation, expert inspection notwithstanding.

SIXTY YEARS AGO.

From the "Journal" for December, 1857.

A Comparison of Gas Companies' Accounts.—It appears to us opportune, at a moment when an untoward incident has been seized hold of for resuscitating charges of extortion and oppression against the Metropolitan Gas Companies, which have been long since disproved, to avail ourselves of the publicity given of late years to the balance-sheets of most of the Companies, for ascertaining on authentic data the financial statistics of the gas-making trade of the Metropolis. . . . The table presents a remarkable coincidence between capital employed by each Company in earning a certain gas-rental, when the variations in the charges for gas are taken into consideration. Reducing all to the uniform standard charge of 4s. 6d. per 1000 c.ft., it will be seen that, with few exceptions, an average capital of about £450 is employed for every £100 of gas-rental. The Chartered and South Metropolitan stand considerably below this average, in consequence of their having in past years paid for their extensions out of profits; but this expenditure must be treated as a debt due to the shareholders, and may, by the authority of Parliament, be converted into debentures, as was the case with the Imperial Company. Certain irregularities in the issue of the original shares of the London will explain the excessive nominal capital of that Company; and the advantageous terms upon which the Commercial Company purchased the land upon which their works are erected accounts for their moderate capital. Assuming that a capital of four-and-a-half times a gas-rental, at 4s. 6d. per 1000 c.ft., is invested and employed by the Metropolitan Gas Companies in carrying on their undertakings, it will require that every £100 of rental should yield £27 profit in order to pay a dividend of 6 p.ct.—a profit attained by only one Company (the Phœnix), who charge 5s. 6d. in a small portion of their district, and whose works are most favourably situated for the delivery of coals and for the sale of the residuary products. A remarkable instance, in the contrary direction, of the incubus hanging over such undertakings, for want of similar facilities, is to be found in the case of the Chartered, where all the materials have to be carted, and other expenses incurred, whereby their earnings are reduced to £17 16s. 5d. for every £100 of gas-rental (the minimum of all the Companies)—a result which may be expected to induce the Directors to consider the practicability of removing their factories to more eligible sites. A positive economy of upwards of £10,000 per annum might unquestionably be effected by such a measure; and it is worth while seriously investigating whether it may not be carried out without trenching upon the present profits of the undertaking. The Paris Gas Company sold the sites of three of their works in populous neighbourhoods for more money than the new works built to replace them, out of the city, will cost.

The Late Mr. Hepworth and the Gas Institution Benevolent Fund.

We are informed by Mr. W. T. Dunn, the Hon. Secretary of the Benevolent Fund of the Institution of Gas Engineers, that he has just received for the fund a cheque for fifty guineas from Mr. F. Hepworth, son of the late Mr. Joseph Hepworth, of Edinburgh. The deceased gentleman, who always took an active interest in the objects of the fund, had expressed the wish that as soon as his estate was finally settled, his Executors should send this contribution.

Lowering a Length of Eight-Inch Main.—On account of alterations in level incidental to the construction of a new boulevard at Omaha (Neb.), a run of some 450 ft. of 8-in. cast-iron main had to be lowered to the extent of 4 or 5 ft. Having laid a temporary 4-in. bye-pass to maintain the supply, the ground was cut away under the pipes to the required depth, with the exception of sufficient support under each joint, to safely carry the pipe. Four 2-inch holes were next drilled at each end of the length of pipe. These preliminaries being completed, a start was made early one morning by fitting main stoppers into each of the first two holes, a 20-ft. length of 2-in. pipe into the third, to act as a vent, and another stopper into the fourth. These precautions were necessary, because of the pressure on the main. A portion was then cut out in the centre, one pipe entirely removed, and the adjacent ends trimmed. After plugging the open ends, the two halves were steadily lowered by gradually and uniformly removing the ground under the joints. The new position having been attained, they were re-connected, and the flow of gas resumed; the whole being carried out in one day, with the exception of the preliminaries. The joints were cement, faced with lead wool, and were caulked and re-tested before filling in the ground.

WAR CONDITIONS AS AFFECTING SMALL GAS UNDERTAKINGS.

By NORTON H. HUMPHRYS, of Salisbury.

[A Paper read at the Meeting of the South-West of England District Association of Gas Engineers, Dec. 12.]

This important subject cannot be fully considered within the limits of time at disposal; and I do not attempt anything like a complete survey, but rather submit a few notes bearing on salient points for your examination. Many other details—such as the quality of coal, and the effect of recent Government arrangements thereon, unlimited Government competition for labour, &c.—will doubtless occur to you; but I take the liberty of suggesting to the President that subsequent remarks might with advantage be confined to the subjects dealt with in the paper. Thus a discussion remarkable for wide range, but also for shallow depth, may be avoided.

The chief effects on our industry, in common with all other commercial enterprise, are caused by an enormous and unprecedented depreciation in the value of money, accompanied by an equally colossal advance in the cost of all kinds of material and labour. Previous commercial crises have influenced one item only, such as coal, iron, or wages. The present conditions have never been approached before, either in respect to the extent of increase or wholesale character. The usual practice among manufacturers and dealers is to pass the whole of such responsibilities along to the purchaser in the form of unrestricted increase of price. More than this, in many lines the reduction in supply has so increased the demand, especially in regard to the absolute necessaries of life, that panic prices and extortionate profit are obtained, to such an extent that the Government has directed special attention to excess profits, and participation in them by means of a super tax—to its own benefit, but to the disadvantage of the purchaser, as the making of such profits is thereby legalized and encouraged, under the excuse of helping the Government. In appeals on behalf of War Loans, the extensive existence of largely increased incomes is always a plank in the platform. The explanation is that restrictions on selling prices and profits are the exception rather than the rule. They are applied only to particular classes of trade, and in no sense in a general way. Very few sellers have cared to accept the nebulous privilege of so-called "freedom from competition," obtained at the price of obligations that at the best far exceed the advantage thus secured.

CURRENT VALUES OF GAS SECURITIES.

What are the value of gas securities to-day? For years, they occupied a prominent, if not a leading, position among local investments, as affording a steady and reliable, although not a high rate of, profit, and capable of fetching a fair price as compared with cost, if circumstances should at any time necessitate their realization. Many of the numerous small gas undertakings scattered over the face of the country are essentially consumers' companies. They are not quoted on the Stock Exchange, are chiefly in the hands of local residents or their relatives, and new capital, when issued, is almost entirely taken up by the existing shareholders. Under the auction clauses, such new capital has been placed, previously to 1914, at prices that will secure 4 to 5 p.ct. profit on the purchase price. As an example, I refer to the shares in an average small gas concern, subject to the restrictions usual with Unopposed Provisional Orders, that for many years averaged 7 p.ct. dividend on the original shares, $4\frac{9}{15}$ p.ct. on the new, and 4 p.ct. on the debenture stock. It is in the not uncommon position of never having been able to pay maximum dividends. The original shares stood for years at about £15 per £10 share, and the new shares at £4 less.

Originals, average price realized in July, 1915 . . .	£14	0	0	per share.
" " " " " March, 1916 . .	7	0	0	" "
" " " " " November, 1917 .	8	2	6	" "
New, " " " " " " .	6	2	6	" "

Depreciation on latest quotation, original, £6 17s. 6d.; new, £4 17s. 6d.

All these sales were by public auction, advertised in the usual way, and therefore present fair average conditions.

TERMINABLE DEBENTURES.

Many small companies prefer terminable to permanent debentures. I do not know why, seeing that the money is irrevocably sunk in capital outlay and cannot be recovered. There seems to be an idea that as the business enlarges and its position improves, they can be renewed at any time on advantageous terms. The incongruity of applying temporary income to the liquidation of permanent expenditure is exemplified under present circumstances, whenever 4 or 5 p.ct. debentures issued at par fall due. A few large holders of ordinary shares are willing to renew, as a means of maintaining the value of their holdings; but without this inducement there is a general tendency to foreclose. The result is that many companies find themselves in the unenviable position of not being able to meet their liabilities. Not only have they no spare cash, but the probability is that they are already considerably overdrawn at the bank, on account of the larger and more costly stocks of materials that are now necessary; and they must not issue new debentures at less than par or to carry more than 5 p.ct. interest—conditions that are practically prohibitive, as no one will invest on such terms.

VARIOUS RATES OF MAXIMUM DIVIDEND.

The reason given for allowing original capital to receive 10 p.ct. dividend, while newer capital is limited to 7 or even only 6 p.ct., is that the original shareholders have borne the burden and heat of the day. But, against this, it should be remembered that almost without exception they secured their property at face value. Bearing this in mind, they have long since received all that is due to them for back-dividends; and a more equable division of profit as between the various classes of shares is much overdue. The difference is not so evident as long as maximum dividends are paid; but when the original dividend falls to 6 p.ct., a purchaser of new capital a few years ago at a substantial premium, after paying income-tax, gets a bare 3 p.ct. on his money, or, allowing for debased value, about $1\frac{1}{2}$ p.ct. For a long while the original holder has been looked upon as having the best end of the stick; but now his advantage is so prominent that a more equable division of profits is urgently called for.

FLOATING CAPITAL.

In connection with this subject, the increase in working or floating capital, necessitated by higher prices and the need for running larger quantities of coal and other necessaries that are uncertain in supply, must not be overlooked. An old-established rule is that 10 p.ct. on the total investment is ample for this purpose, and will admit of all puchases being made upon net cash terms. Many contrive to run on less than 8 p.c. But to-day the floating capital required is nearer 20 p.ct.; and many have no funds available for this additional demand, and are obliged to resort to a 6 p.ct. overdraft at the bank, which, on the basis of the mysterious ways by which bankers calculate interest, comes out at the end of the year to be nearer 7 p.ct. The result is a large cut into the already small profit applicable for dividend.

NEED FOR REDRESS.

The interests of existing holders of gas securities call loudly for redress on personal grounds, seeing that as a rule it is urgent need for ready money that compels people to sell out, or the winding-up of an estate. In either case, a depreciation to the extent above instanced is a very serious hardship. We are more concerned, however, with the effect as regards future issues of capital. We hear a great deal about developments that will come after the war; that we have only just touched the fringe of industrial possibilities; that arrears in the building trade will be rapidly taken up, &c. But how is it possible to follow a progressive and enterprising policy, in the absence of means of raising additional capital on terms that are fair and just to the rights of existing holders?

THE REVENUE ACCOUNT.

As a general thing, small gas undertakings are selling gas on unremunerative prices, all things fairly considered. This may be partly due to the presence of a controlling interest of consumers on the directorate; but the chief reason is that nothing further than the real contingencies of the moment are seriously considered. It is to be hoped that neglect in this respect will prove less disastrous to our industry than has been experienced in connection with our national affairs. The directors, and frequently the manager also, are loth to increase prices to a figure that will provide for adequate maintenance, repair, and depreciation—to say nothing of a return that, under recent circumstances, is reasonably fair and remunerative to the shareholders. In this respect they are unique; for I know of no other instance in which the convenience of the consumer, his ability to meet increased expenses, or the effect of doing so in connection with local or national prosperity, has received the slightest consideration.

Examine the revenue account of your own or any other gas company, following the expenditure item by item, and it will be found that almost the only detail that is not subject to unlimited increase is the manager's salary. The general tendency is exemplified by the coal traders, who were recently able to obtain a rise of 2s. 6d. per ton to meet expenses that, without any contradiction, have been estimated at 1s. 8d. Can we wonder if miners imagine that the public goose can lay an unlimited number of golden eggs?

Note the contrast on the other side of the account, where the only items not restricted are coke and the small detail of rents on cookers and appliances. Gas is tied down to a maximum price; and tar and ammonia are reduced far below a living wage by Government limitations on sales and prices, to such an extent that, notwithstanding tar and oil washing, the net profits are less than in pre-war times. It is impossible to conduct business on fairly remunerative terms when we have to sell at restricted rates and buy at anything that the suppliers choose to charge. A request for even conditions on both sides of the account is not a demand for "favoured nation" consideration, but merely levelling-up in line with average market conditions, and relief from a condition little short of ruinous, for which there is no parallel.

The attached table, showing the present, or rather the past, year's cost before the new coal regulations came into force, of making and selling gas, as compared with the same items four years ago, will illustrate the point. A and B are two fairly representative companies in this district; and the figures are abstracted from the audited balance-sheets. The increase of expenditure is about 10d., of which the consumers have contributed 5·7d.; the

COST OF GAS IN 1912-13 AS COMPARED WITH THAT IN 1916-17.

	1912.	1912.		1917.	1917.		Increases.		Decreases.	
	A	A	B	B	A	A	B	B	A	B	A	B
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Gas, less discounts and public lighting expenses	3 4'5	..	3'0	..	3 9'3	..	3 6'0	..	4'8	6'0	..	..
Rent of meters and appliances	3'2	..	5'4	..	3'8	..	5'5	..	0 6	0'1	..	..
									5'4	6'1		
Coal, less receipts for residuals	..	1 3'5	..	5'4	..	1 7'6	..	11'7	4'3	6'3	..	..
Repairs (seven years' average)	..	8'0	..	8'6	..	7'8	..	6'0	..	..	0'2	2'6
Wages (including small purification charges)	..	3'7	..	5'1	..	6'0	..	6'7	2'3	1'6	..	..
Salaries and establishment charges	..	6'6	..	5'6	..	9'2	..	9'8	2'6	3'5	..	..
Net cost of gas	..	2 9'6	..	2 0'7	..	3 6'6	..	2 9'5	9'2	11'4	..	..
Profit	..	10'1	..	1 4'7	..	6'5	..	1 2'0	..	..	..	..
	3 7'7	3 7'7	3 5'4	3 5'4	4 1'1	4 1'1	3 11'5	3 11'5	..	..	..	..

remainder being divided between the shareholders and the potential resources of the concern.

But, before closing the comparison, we must consider the position of the repairs, maintenance, and depreciation accounts; and to get a fair basis I have substituted the average over the seven years 1907 to 1913 in the second and fourth columns. In A, the expenditure under these heads is slightly, and in B very substantially, less, notwithstanding the large increase in the price of all kinds of material and labour. The work usually carried on by the companies' own staff is practically at a standstill; the military having cut down to the bare daily manufacturing staff, and even restricted that. In the supply of metal of any kind, there are the delays due to the priority regulations, and the inability of manufacturers generally to keep pace with orders. Not only superfluities, but bare necessities, have been staved-off. Depreciation on meters and cookers is usually provided for by outlay on new apparatus, rather than by a sinking fund; and to this extent nothing has been done, and a draft has thus been drawn on the future. The staving-off of painting and renovating, so far from getting rid of the responsibility, increases it, and the forced neglect of the present means not less, but increased, costs in the future. Unless a sufficient sum to cover the cost of deferred work is charged against profit, and laid by as a contingency fund, the indefinite period known as the end of the war will find many undertakings in a position, as regards wear and tear, similar to that already instanced in connection with terminable debentures. They will have no accumulated profit or reserve, and will be called upon to face an extensive accumulation of arrears on renewals and repairs of neglected plant, arrears of renewals and extensions in the district, and probably demands for a reduction in the price of gas—and this without any resources for meeting these claims. For these reasons, a fair allowance for repairs, &c., in 1917 would be more like 1s. or 1s. 2d.

But this is not all. The reduction in the amount of the net revenue amounts to about 3d.; and a reduction of dividend has been necessary. Not only as a matter of common justice to the shareholders, looking at the debased value of money and heavy taxation, and the increased cost of living—I know no reason why this consideration should be confined to the class that is all more or less profiteering through the war—the shareholders should all receive maximum dividends. Apart from this, there are no other means of saving the position of gas securities. With a 6 p.ct. bank rate, a 4 p.ct. dividend is an absurdity, in the view of the capitalist.

In past years, the folly of bolstering-up a low selling price or a high rate of dividend at the expense of repairs and renewals, has been repeatedly exposed. Yet this is exactly the policy that is being followed to-day, although the fact that it is a headlong course leading to destruction still holds good. A trifling addition to the selling price, a reduction of dividend, and delusive of the character sometimes described from the chair as "the exercise of every possible economy," but which frequently means the cutting out of necessary outlay, is a sure way of making future trouble. Procrastination is worse than useless, and a 2d. or 3d. advance is a mere sop in the pan—9d. to 1s. would be nearer the mark.

THE REMEDY.

The once highly valued privilege of a Special Act or Provisional Order is now a doubtful blessing, and many would be better off without it. The financial edifice of restrictions on issue of capital, classing of shares, rates of dividend, and selling price is built on the foundation of cheap capital at premium prices; and when the foundation collapses, the whole fabric necessarily follows suit. What is the value of prohibitive restrictions on the issue of capital; of maximum dividends that cannot by any possibility be earned; or of a reserve fund when there is no prospect of anything to reserve? Many of these have been noted as obsolete and useless; but as they were harmless, it was nobody's business to clear them out of the way. Possibly fitted to the remote times in which they were drafted, they have long since been out of touch with the more modern conditions. But they have now taken a cankerous form that threatens the vitals of the industry. The testing clauses would here be included, if the Government had not shown that, where their own interests are concerned, they can act promptly and effectually. But in regard to other matters, our representative bodies have so far failed to obtain any concession; and the latest news is that the only way of relief is by a Provisional Order, which may cost anything more than £150, and not be effective for nearly two years.

Parliamentary regulations are intended to act as a just balance between all parties concerned—not to favour one at the expense of the other, and certainly not as a source of personal hardship and loss. Following long-established practice, all restrictions that justly fall under these objections should be abrogated or repealed. Maximum selling prices and auction clauses are now nothing more than legal fetishes, except when they are legal juggernauts, crushing the right of shareholders and the future prospects of the industry. Rates of dividend or of interest should be sufficient to maintain the prestige of gas securities as desirable investments. A maximum price for gas was never of any practical value, especially since the introduction of the auction clauses. In the modern acceptation of Government controlled prices, the maximum is also the minimum. But gas undertakings have never taken it in that light; they have invariably sold at a much lower level, even when they do not pay maximum dividends. It cannot be laid to their charge that they fleeced the public when they had the chance, as many traders are doing now, and that they have no right to complain when the pendulum swings in the opposite direction. Selling at a remunerative rate is a common right, not an exclusive privilege that must be indirectly purchased at the price of an equivalent obligation. It is also a common right to close or repudiate a bad bargain, subject to fair notice.

How many small gas undertakings represented here to-day can claim to have sufficient loose cash at command to pay for a parliamentary application that may possibly lead to opposition, or the means of raising necessary funds on moderate terms? And why should they be mulcted in uncertain expenses in regard to matters that can be remedied by a mere stroke of the pen? Many would be well advised, assuming that they had the right, to destroy their Provisional Order as an alternative. When the disease takes a virulent form, palliatives are useless, and recourse must be had to drastic remedies. The position in the gas industry is now so serious that it cannot be effectively dealt with by a reconstruction of the existing restrictions at great expense and much loss of time. Nothing short of a repeal of the clauses above instanced will fill the bill; and a few other useless incumbrances might be cut off at the same time.

AFTER THE WAR.

It is a great mistake to regard these things as a mere temporary inconvenience—a passing cloud that will speedily be followed by the sunshine of pre-war prosperity; or the declaration of peace as tantamount to an instantaneous return to normal conditions. It is vain to prophesy; but some importance may be attached to historical precedent, and we may safely conclude that, so far from an instantaneous, there will not be even a rapid return to "as you were." The Franco-Prussian War crippled France, in an industrial sense, for quite ten years, though the total cost, inclusive of the war indemnity, was a mere fraction of our current expenditure; and France lost no merchant shipping. Any temporary abrogation of restrictions must therefore be concluded by direct commercial conditions, not by indirect National events—not by the duration of the war, but by the duration of the abnormal commercial and financial conditions that are incidental thereto, such as the value of money, the cost of materials and labour, and general business conditions.

Some of these arguments will be met in Micawbian style by parrot-like cries of "pessimism" or "unpatriotic." No one is more willing than myself to shoulder a fair share of the war burden, or even more, if assured that it is really for the benefit of the Nation, and not a personal gain for some acute contractor. So far from this being applicable to any of the restrictions that we have been considering, anything tending to reduce profits also reduces the 25 p.ct. income-tax thereon.

Mr. CHARLES BRYANT, the Chairman of the Camborne Gas Company, died suddenly in a tram-car, last Tuesday evening. He was 67 years of age, and had been connected with local banks for about half-a-century.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Meeting of the Association was held last Saturday week, at the Leeds University. In the absence of the President, Mr. Ed. Garsed, the chair was taken by Mr. M'LUSKY (the Senior Vice-President).

Mr. E. L. OUGHTON read a paper entitled "A Review of the Development of Gas-Heated Water Appliances: Some Criticisms and Suggestions." [This will be found on p. 559 of last week's issue.] The paper was illustrated by a series of large drawings, and a number of experiments. The author called attention to the fact that, though many of his examples were on the market, he had abstained from mentioning names, because he had no desire to make the paper an advertising puff of any particular patents. He did, however, make special mention of two geyser water-heaters, which were the inventions of a past Vice-President of the Association—the late Mr. H. H. Townsend—and his brother, Mr. W. W. Townsend, who had joined the Colours, and, to the regret of the members, had both made the supreme sacrifice. He was glad to take this opportunity of paying a tribute to the good work done by members of the Association.

DISCUSSION.

The CHAIRMAN said they would all agree that the paper had been an exhaustive one. It was necessary that the man who handled the sales department should have a good and impartial knowledge of the principles underlying the many varieties of any article in his charge. It was notorious that one did not expect more than 50 p.ct. efficiency from a ring-burner and kettle. It was remarkable how conservative makers had been in regard to improvement of the hot plate. As to wash-boilers, a large number were of the cheap galvanized type, fixed by landlords who, having to instal a boiler of some sort, put in the cheapest; and, when they were placed in a cold, damp cellar, their life was not long, and the reputation of the system gained nothing. He had seen wash-boilers which had not had a draft tap fitted. In regard to hot-water geysers, he thought Mr. Oughton might, with advantage, emphasize the material of the trough in relation to its length of life.

Mr. F. PYKETT (Halifax) asked whether Mr. Oughton had carried out in personal experience any comparisons with the figures given by the makers of the various types of apparatus—whether he had taken gas consumption and volume of water passed through, &c., in comparison with the efficiency claimed by the makers. The paper was vastly interesting; but they could not go into it in such detail as they would like, as it was impossible to grasp all its points on mere reading. They would have to study it when it appeared in the Press. He wished it were possible to have some advance copies of the papers circulated among the members; so that they would be better prepared to discuss the points on which they might have particular knowledge. The facts and figures could not be completely followed on hearing the reading alone. He had had trouble in two houses at Halifax in his own experience of these domestic appliances. One of the houses was his own home, in which they could not get a cooker to go properly without a door open connected with a flue. They fixed a geyser with an open tap, fitted with flat-flame burners; and they found that they had exactly the same trouble—the thing being smothered out unless they opened the door or the window. On the other hand, it went all right without the door or window open if there was no fire in the house. Therefore it seemed to him that the root of the trouble was not with the cooker or the geyser, but with the ventilation of the house.

Mr. A. EDWARDS (Leeds) remarked that Mr. Oughton had omitted to mention that all his various vessels must be fully covered and surrounded, otherwise his figures did not apply.

Mr. E. J. SUTCLIFFE (Bradford) asked Mr. Oughton if he knew what was the objection of water-supplying authorities to having such apparatus connected-up direct. In Bradford, for some reason, the water authorities objected to having these things connected to the ordinary supply. In putting in such appliances they had to get special cisterns, &c. The same thing applied to steam-boilers, in regard to which they had to connect-up a tank and pump up the boilers. The reason the water people gave was that occasionally the valve failed, and the hot water got back into the main. He thought that this was rather a ridiculous objection.

Mr. H. W. WILLMER (Bradford) said that he was not very much in favour of the geyser, and preferred circulating water heaters attached to the house supply. They gave better results, and, of course, they could draw at practically any point.

Mr. J. E. HOLLIDAY (Yeadon) said Mr. Oughton had mentioned two ways of making the circulators—cast iron and copper. He had mentioned some special treatment for rendering the inside of the boiler rust proof. Had he anything to say as to the effect of the products of combustion of gas on the outside of the boiler? He (Mr. Holliday) had seen circulators covered with a bluish-white product. Was this some action on the copper?

Mr. PETER M'NAB (Low Moor) endorsed the author's opinion that those responsible for the sales department should know the whole range of the appliances under their control. Furthermore, such persons should have sufficient technical and practical knowledge of the subject to ensure that suitable conditions prevailed in order to give the apparatus, which their "commercialism" had sold, a fair chance of doing what they had stated—and this without detriment to any other department of the same concern. For example, large apparatus, such as geysers, &c., often required gas at the rate of 60 c.ft. or more per hour to be effective. This would be taken into consideration by the technical and practical man, when selling such appliances, and have the double effect of bearing upon the life of the gas-meter, and helping to secure the best advertisement—a satisfied consumer. He did not believe in working a meter at double its stated capacity, and then expecting it to be efficient and last the same period as one worked normally. He agreed with Mr. Oughton that it would be better if some of the geysers were more accessible for internal cleaning and repairs. What could Mr. Oughton say, from experience, with regard to the claim of 20 p.ct. additional boiler surface utilized with luminous flames? If time permitted, further information on the question of the circulator *versus* the multi-point type of geyser would be appreciated.

Mr. H. RHODES (Bradford) bore out Mr. Pykett's remark as to the advantage of having copies of a paper in advance. Personally, he was never much struck with geysers until one case which he had on hand changed his opinion somewhat, because they got very good results from the one put into a certain house. It was fixed on its one point just for the bath. He had tried with the Bradford Water Department to get one in a house, and offered to take the water from the ordinary bath supply. The water authorities would not even give permission for this much. On the matter of boilers, the great detriment was the cheap boilers which were made with what was called a condenser on the top, which was no condenser, but only a dummy.

Mr. OUGHTON, in reply, answered most of the questions by giving information in regard to specific makes of appliances which he did not desire to be published. It was worth while to know which water authorities objected to directly-connected geysers. Accidents would happen, of course; but they could have directly-connected geysers which were quite safe under almost any conditions. It seemed to be just a question of prejudice. They might have an argument for their use; but he did not think that they had any real case. He had made personal tests of the various appliances, and compared their efficiency with the claims of the makers. It had been an oversight on his part that he had not, as Mr. Edwards pointed out, mentioned the complete covering of the vessels. He fully appreciated Mr. Edwards's point; but, of course, the drawings of the afternoon were only comparative, to explain the principles. As to circulators *versus* geysers, with the multi-point geysers they ran the pipe the shortest length, and there was flow and return as separate pipes. Immediately the first tap was open, the gas turned on full, and they had simply the water to draw off in the single length of pipe. Therefore the loss was simply a temporary one, because it was hot water continuously circulating which was lost. The circulator was fixed in conjunction with all the pipes in the house. As to Mr. Holliday's question about deposits, it was chiefly a question of the proper fitting-up of the condensation set. Both geysers and circulators had their place; and it was for everyone who was fixing the appliances to know which to put to a particular purpose. They each had a claim; but members of the industry were liable to lose sight of the advantages of the multi-point geyser type in hearing so much about the circulator.

A hearty vote of thanks was awarded to Mr. Oughton for his paper.

SCOTTISH JUNIOR GAS ASSOCIATION.

[EASTERN DISTRICT.]

Last Saturday week, Mr. J. J. Scott (the President) and a party of members of the Association visited the gas-meter testing-station and the Gas Commissioners' model show-rooms at Edinburgh, when a most interesting afternoon was spent.

The members met at the City Chambers, and were welcomed to the meter testing-station by the head of the department—Mr. W. Gordon. A short address was then delivered by Mr. Gordon, in which he described the early methods of measuring gas, before the introduction of the meter. He also described the cubic foot bottle which is used for verifying the capacity of test holders. The city authorities have in their possession a record of every meter tested in Edinburgh since 1861. Nearly 3,000,000 meters have passed through their hands in this time, representing a sum of £90,000 in stamping fees. The members were then shown over the station, when the various test meters and holders were fully explained by Mr. Gordon. Mr. Scott, on behalf of the members, thanked Mr. Gordon for his kindness, and for the privilege of visiting the station.

The party then adjourned to the show-rooms, where Mr. Alexander Masterton (the Gas Engineer) welcomed them. The show-room staff showed the members round.

The Late Mr. W. Beckford Long.

Among the editorial notes of this month's issue of the Gas Light and Coke Company's "Co-Partners' Magazine," appears the following: Exactly a year ago in the December, 1916, number of the "Magazine," the appointment of Mr. W. Beckford Long as Secretary of the Company, in succession to Mr. H. Rayner, was notified. The new Secretary was eminently fitted for his responsible post by conspicuous ability, high character, and great experience in the work of the Company; and his subsequent discharge of his duties throughout this particularly exacting period promised well for his own and the Company's future. It, now, however, becomes our sad task to record the painfully sudden end of all these hopes. Mr. Long was in his office on Saturday, the 1st inst., apparently in his usual health; but he was later seized by an attack of peritonitis, from which he died on the following Monday. We are quite sure that the whole body of co-partners of the Company will share in the deep regret at his early death which is felt by all those with whom he was associated in the business of the Company, and especially by the Directors, whose full confidence and appreciation the late Secretary deserved and enjoyed. Mr. Long was Secretary of the Co-partnership Committee from the foundation of the scheme, and also acted as Secretary of the War Distress Fund Committee.

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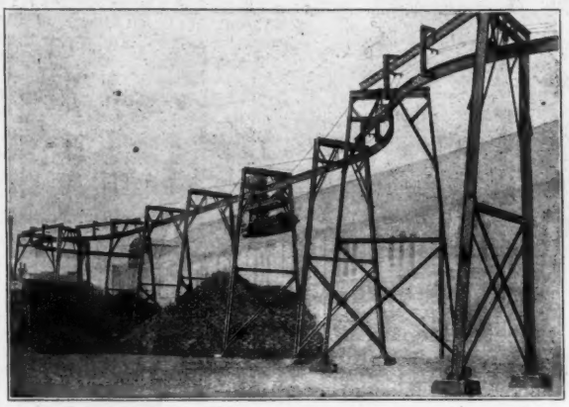

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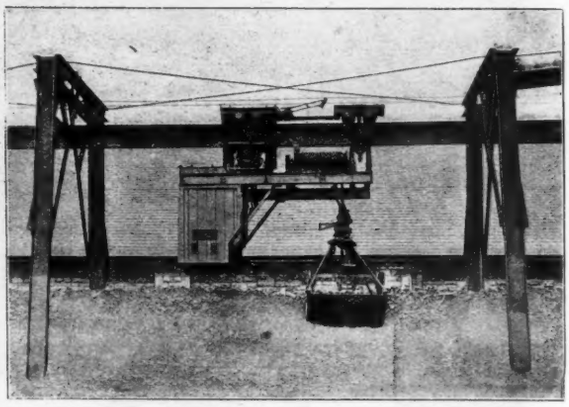

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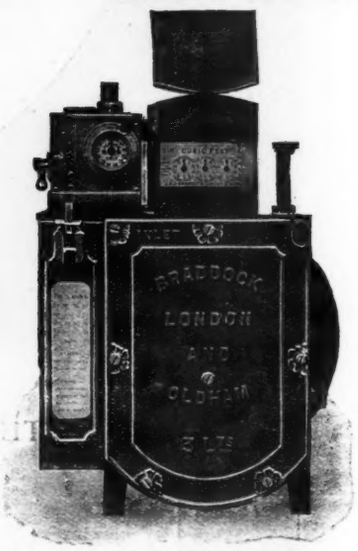

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COKE-OVEN MANAGERS' ASSOCIATION.

MIDLAND SECTION.

A Meeting of the members of the Midland Section of the Coke-Oven Managers' Association was held at the Grand Hotel, Sheffield, on Dec. 15. The PRESIDENT (Mr. J. W. Lee) occupied the chair.

Mr. G. A. HEBDEN (Portsgate) read the following paper:

THE MANUFACTURE OF CONCENTRATED AND PURE LIQUOR AMMONIA.

Liquor ammonia is a more or less concentrated solution of caustic ammonia in water, and is usually manufactured by the distillation of ammoniacal or gas liquor obtained from the gases evolved in the carbonization of coal.

CONCENTRATED AMMONIA.

This is a more highly-concentrated liquor, containing 25 p.ct. of NH_3 and not more than 0·5 p.ct. of H_2S, used in the ammonia soda process.

PURE LIQUOR AMMONIA.

This contains up to 30 p.ct. of NH_3 and no H_2S, phenols, pyridine, and tarry matters. It is used as a basis in the manufacture of pure ammonium compounds, also in the dyeing, bleaching, scouring of wool, and calico printing industries, also for making cyanides for gold extraction.

Crude ammoniacal liquor, obtained from the distillation of coal, may contain the following compounds:

A.	B.	
Ammo. carbonates	Ammo. chloride	Ammo. thiocarbonate
,, sulphides	,, sulphate	,, sulphocyanides
,, hydrosulphides	,, sulphite	,, ferrocyanides
,, cyanides	,, thiosulphate	

Besides these they contain tarry matters, phenols, salts of organic basis (chiefly of the pyridine group), and oily matter. Those bracketed under A are volatile, and can be eliminated from the liquor by prolonged boiling. Those bracketed under B remain in solution; and the ammonia contained in them must be recovered by heating the solution with caustic lime. These are important distinctions in the practical working of ammoniacal liquors.

In the manufacture of concentrated and pure liquor ammonia, it is first of all necessary to remove the carbon dioxide and sulphuretted hydrogen from the crude liquor. The method of doing this is based on the fact that, on heating crude gas liquor to about 95° C. to 100° C., the CO_2 and H_2S splits off from the NH_3 and escapes; while the NH_3 remains behind in the liquor, and can be driven out later on by raising the temperature.

The necessary plant for the distillation of ammoniacal liquors and the manufactnre of concentrated and pure liquor ammonia consists of: (1) Liquor storage and settling tanks; (2) decomposer or decarbonater; (3) lime mixer and agitators; (4) free and fixed ammonia still, or finishing still; (5) necessary condensers, absorbers, and storage tanks for the products; (6) purifying plant; (7) pumps, &c.

PROCESS OF DISTILLATION.

1. *Removal of Sulphuretted Hydrogen and Carbon Dioxide.*—This is usually done in a decomposer or decarbonator. There are various types of decomposers; but practically all of them work on the principle of the continuous ammonia still. The heating of the still is by direct steam fitted into the bottom chamber or tray. In some cases, indirect steam is fitted into the other trays, though personally I have never used this type of decomposer.

The ammoniacal liquor distilled usually contains 1·60 p.ct. of free NH_3, 0·45 p.ct. of fixed NH_3, 1·7 p.ct. of CO_2, and 0·24 p.ct. of H_2S. The liquor, after being freed from tarry matter [the settling of the liquor free from tar is most important, as if a small portion of tar is distilled with the liquor, one is apt to get naphthalene troubles in the gas outlet from the still, and also tar, if it sets fairly forward, neutralizes the action of the caustic lime], was pumped into the decomposer. One half of the cold liquor passed through the tubes of Nos. 1 and 2 ammonia condensers (these acting as a heat interchanger between the hot ammonia gases and the cold liquor); the liquor entering the decomposer about half way (this, of course, depends on the size of the still), the other half of the cold liquor entering on the top tray. Thus the cold liquor has a cooling effect on the gases about to leave the decomposer; and the other liquor, entering the still hot, reduces the amount of direct steam to be used on the bottom tray for decomposing—incidentally reducing also the amount of water vapour entering the still as direct steam.

Working Conditions of the Decomposer.—The temperature of the liquor in the bottom tray was kept about 100° C. to 105° C.; the pressure, 10 to 12 lbs. per square inch; and the pressure of steam on the main, 50 lbs. per square inch. Under these conditions, we never got the percentage of CO_2 above 0·10, and the H_2S 0·03. The temperature of the gas from the top of the decomposer was kept at about 45° C., and always contained a small amount of free ammonia. These gases were then passed through water catches, which absorbed any ammonia, and, of course, a certain amount of CO_2 and H_2S. The liquor from these catches was worked up into crude ammonia, or run back into the gas liquor storage and worked back again through the still. A certain amount of liquor was taken from the catches each day, and water put back into the catches to replace it. The foul gases from the catches, freed from ammonia, were then passed through beds of oxide of iron, and the H_2S absorbed. The decomposed liquor was then pumped into the free ammonia portion of the finishing still, entering it at the top tray (which was larger than the other trays). The lime liquor was pumped into the still on the third tray, which was also larger than the others.

The method we adopted for lime mixing was as follows: From the analysis of the gas liquor the amount of lime required was calculated. A weighed charge of lime, sufficient in our case to last three hours [the amount of liquor passing through the still in this time was taken as a basis of calculation for the weight of the charge of lime], was put into a lime mixer. This consisted of an open pan fitted with perforated plates about 9 in. from the bottom, a centre shaft fitted with propellers, working underneath the plates, and the necessary gearing for driving same. Sufficient hot spent liquor—water was only used for washing the pan out—from the bottom of the ammonia still was used to slake the lime, and mixed with it, so that the mixture would allow of being pumped. This mixture was then run from the bottom of the pan, the propeller agitating it all the time, over a grid into a rectangular box. At the same time as the lime liquor was run into the box, it was pumped into an agitator.

These agitators (three in number) were cylindrical vessels, stood on end, and fitted with a centre shaft, on which were bolted propellers driven from the same shaft as the lime mixer. They were also fitted with pressure gauge, liquor inlet and outlet, liquor gauge, steam-coil for heating up after being shut-down, and a gas vent. After the lime liquor had been charged into the agitator, condensings from the various condensers were run in and mixed thoroughly with the lime; the whole being kept agitated by the revolving propellers. These did not run at a great speed—just sufficient to keep the lime from settling out.

During the filling of the agitator, the vent was opened to relieve the pressure. This was usually ammonia vapour, and was conducted into the ammonia-still. On starting to use the liquor from the agitator, the vent was opened into the air. One agitator was charged while the liquor from the other was being used. The principle of this method of lime mixing was to use the minimum amount of water, thereby getting a greater still efficiency, and also the better control of the amount of lime used per ton of liquor. The amount of liquor was regulated on the decomposer by the speed of the feed pump, and the amount of lime liquor in the same manner. Both these pumps were fitted with tachometers. With the mixing of the condensed liquor (which consists mostly of free ammonia) with the lime, the free ammonia is rapidly given off in the hot still; leaving the lime to mix with the decomposed liquor freed from a great portion of the water which is used in the usual method of working.

Working Conditions of the Free and Fixed Still—The top tray of the still was worked under a pressure of 6 lbs. per square inch. This was sufficient to send the gas through the whole plant. The bottom tray was heated with direct steam; the pressure on this tray being 8 lbs. per square inch. The spent liquor ran away through a seal into brick settling tanks placed above ground; so that the lime, after settling, could be loaded-up and carted-away more easily. Tests of the waste liquor leaving the still averaged about 0·005 p.ct. of NH_3.

The ammonia vapours passed away from the top of the still, first into a small trap to catch any liquor which at times comes over with the gas (this trap was sealed, and the liquor ran back into the still), then the gas passed through three condensers, which were fitted with cast-iron tubes, through which passed the cold gas liquor—the gases being cooled and the liquor, preheated, passing on to the decomposer. Afterwards we found we could use wrought-iron tubes. As the condensed liquor was made in Nos. 1 and 2 condensers, it was used up in the agitators. Tests of liquor from the condensers showed: No. 1 = 2·5 p.ct. NH_3; No. 2 = 7·4 p.ct. NH_3.

If concentrated liquor was to be made, the condensings and gases from No. 3 condenser were passed into absorbers made of cast iron, arranged so that they could be worked in series. To ensure complete condensation of the ammonia, these absorbers were fitted with coils for cooling water. This water, after passing through the coils, ran into the boiler feed-tank. The number of condensers required depended, of course, on the amount of gas to be cooled. The inert gases from the absorbers passed through coke-towers fitted with water-sprays. The ammonia water from these ran into a common sump, into which also ran any drainings from leaking pump glands, liquor gauges, &c. The concentrated liquor contained 25 p.ct. of NH_3 and 0·15 to 0·25 p.ct. of H_2S.

Purification of the Ammonia Vapours for the Making of Pure Liquor Ammonia.—When pure ammonia was required, the gases, of course, had to be purified. The gases leaving the last condenser were passed through three more air-cooled condensers [it is essential that before purification the ammonia gases should be as dry as possible, and not above 15°C.], then through caustic soda washers which absorb any traces of carbonate, and then through slacked lime purifiers, which extract the final traces of sulphuretted hydrogen. The gases still contained small amounts of phenols, pyridene, &c. These were extracted by passing the gas through oil-washers; the oil being changed at regular intervals. The gases after leaving the oil-scrubber were passed through

coke-towers, to trap any oil which might be in suspension, then on to the ammonia absorption tanks.

The absorption of ammonia produces a considerable amount of heat, and necessitates the cooling of the absorption vessels. These are usually ordinary closed iron tanks provided with an inside coil of pipes for cooling. The tanks are used in turn. The tank which contains the strongest liquor receives the fresh ammonia gas as it comes from the purifiers, and the last tank, charged with fresh water, receives the stream of gas as the last of the set—any inert gases passing to the coke-tower, as previously described.

In our case, boiler-tanks with the tubes left in were used; the cooling water being passed through the tubes, overflowing into the boiler feed tank. The water used for absorbing was put into the boiler itself. The water used for making technically pure ammonia was town's water; but for making chemically pure ammonia the still water was used. The ammonia liquor is blown up to the desired strength ready for sale; 880 and 920 sp. gr. being most in demand.

The method of testing, and the results, were described in detail by the author, who summed up as follows: On the plant described, the amount of liquor worked per day averaged 400 tons; the liquor containing 1·60 p.ct. of free NH_3, 45 p.ct. of fixed NH_3, 1·74 p.ct. of CO_2, and 0·24 p.ct. of H_2S. The lime used worked out to 25 cwt. per ton of liquor worked, and the coal was 1·8 cwt. per ton of liquor worked. They had to purchase all their gas, liquor, and coal for steam raising, and had to use town's water for the steam boilers and cooling, though liquor was used in most cases for condensing purposes. All necessary pumps and machinery were worked by steam. Since working the plants described, the author had erected and altered plants to deal with from 50 to 100 tons of liquor per day on the same system with just as good results. Therefore, pure ammonia should be made on bye-product works even more economically. The making of pure ammonia was certainly the most profitable.

DISCUSSION.

At the conclusion of his paper the author answered a number of questions on points of detail which were put to him by Mr. B. W. HAIGH (Barnsley Union), Mr. J. T. PRICE (Manvers), Mr. J. THORPE (Borough), Mr. RILEY (Tinsley Park), Mr. J. TAYLOR (Silverwood), Mr. J. A. WILSON (Staveley), Mr. H. GREEN (Manvers Union), and Mr. J. MORRIS (Rotherham Main).

Mr. HEBDEN stated that the percentage loss in working was never above 5 p.ct. The number of men required to work the ammonia plant were: One still man, one lime man, one man to look after the filling of the tanks, two men at the boilers, and a chemist in charge day and night. Other plants, of course, as well as the ammonia plant, were kept going with the steam. A boy was also employed continuously during the day going round taking the temperatures and pressures. Asked if it would pay to employ all these men on an ordinary-sized fifty-oven plant, Mr. Hebden said on smaller plants that he had run he had managed with only one man to do the whole job, except the boiler firing and the chemist in charge. He did not think it would be necessary, in order to attain such efficiency as he had described, to have a chemist always on the spot. A chemist during the day would probably suffice, as the speed of the pumps, the mixing of the lime, and other matters became regulated when the practice had been continued for months. It would then be necessary to have a chemist during the day only.

Mr. THORPE said he had been surprised to hear Mr. Hebden mention that he obtained 50 to 55 p.ct. of sulphur in the oxide recovered from the foul gases. His experience in dealing with foul gases had been that it did not really pay to get up to this percentage. It was quite easy in gas-works; but with the stronger gas, the action was so much more vigorous that it covered up the poles and formed a coating of sulphur, which was not very easily broken up. He had found that 40 p.ct. was about the limit which paid; and he would like to know whether Mr. Hebden did not find some difficulty in getting the extra 10 p.ct.

Mr. HEBDEN said there had been no difficulty in doing this, though the last 10 p.ct. certainly took more getting than the other. They used to revivify and get it gradually that way. He had no methods in work which were different from the ordinary gas-works practice.

Mr. THORPE said his experience had been that there was a difficulty in revivifying the oxide that had been treated from the very first with foul gases.

Mr. HEBDEN had not experienced any difficulty in this way.

Mr. PRICE asked for Mr. Hebden's opinion as to whether lime washing the vapours or lime washing the liquors was the more efficient.

Mr. HEBDEN said lime-washing the vapours was the better.

Mr. TAYLOR asked if a certain liquor content was volatile ammonia—say, 20 p.ct. of caustic ammonia, 60 p.ct. of carbonate of ammonia, and 20 p.ct. of sulphide of ammonia—and one had no liquor containing (say) 20 p.ct. of carbonate of ammonia and 60 p.ct. of sulphide, what difference should be made in the temperature of the decomposer gases?

Mr. HEBDEN said that if any more temperature was wanted it was necessary to increase the pressure on the still.

Asked if a higher percentage of carbonate of lime required a higher temperature than a lower percentage, Mr. Hebden said the temperature in his case was never above 105°, and sometimes he had stronger liquors than Mr. Taylor had mentioned.

In answer to a question by Mr. Haigh, the author said he advocated enough storage for 100 days' supply, thinking it much better to make this provision than to work as it was made.

The PRESIDENT observed that Mr. Hebden was using cold liquor in his condensers, whereas they were using water.

Mr. WILSON said the author was freed from a certain amount of trouble by the fact that he wanted a certain amount of ammonia to escape from his decomposers.

Mr. HEBDEN: There is always a good sale for crude ammonia now.

Mr. HAIGH asked what was the difference in value between pure ammonia and the 25 p.ct.

Mr. HEBDEN said when sulphate was fetching £10 to £12 per ton, 880 ammonia was sold at £20 a ton. Now there was a ready sale for 920 ammonia at about £20 a ton.

Replying to a question by Mr. Green, the author said he had no difficulty in washing out the pyridine with oil, and found that a light anthracene oil was the best for this purpose. He could not state what the percentage of pyridine was before the liquor entered the oil scrubber; but there was none left after it had passed through. Mineral oil he had found fairly effective for the purpose, but anthracene oil was the best.

VOTE OF THANKS.

Mr. WILSON proposed a vote of thanks to Mr. Hebden, whose paper had had the advantage that it dealt with many problems that his hearers had to encounter in practice. He himself had had trouble at one time with the slacking of lime. The author had mentioned the use of spent liquor for this purpose; but he (Mr. Wilson) had found that it was better not to use spent liquor, as the temperature of it seemed to produce too coarse a grain in the slacked lime.

Mr. THORPE seconded the resolution, which was carried.

PROGRAMME FOR THE SESSION.

The PRESIDENT, in bringing the proceedings to a close, announced that the programme for the session had now been completed, and they owed their thanks to Mr. Gerald H. Lant, the Hon. Secretary, for the trouble that he had taken in the matter, and for the excellent results which he had attained. On Jan. 26, Messrs. Haigh and Lamb were to give a joint communication at Sheffield entitled "Some Notes on the Comparative Values of Coke-Oven Crude Benzol." On Feb 23, Mr. Greaves, F.I.C., would give, at Leeds, "Notes on the Manufacture of Concentrated Liquor and Benzol." Leeds had been chosen as the place of meeting on some occasions in order that they could spread their work over the area as far as they could. On March 23, Prof. Fearnsides would read a paper at Sheffield on "The Texture of Coke-Oven Bricks." On April 27, Mr. J. D. Hamer would present, at Leeds, "Notes on Benzol Rectification." On May 25 there was to be a visit to Morton's Fire-Clay and Brick Works at Halifax; on June 29 a visit to the Parkgate Bye-Product Coking Plant; on July 27, a visit to the Yorkshire Coking and Chemical Company's works at Glass Houghton; on Aug. 31, a visit to the Silverwood Bye-Product Coking Plant; on Sept. 28, a visit to the Houghton Main Bye-Product Coking Plant; and on Oct. 1 the annual meeting will be held.

Discharge of Gases under High-Pressure.

Among the papers read at the meeting of the Royal Society on the 6th inst. was one on the above-named subject, by Mr. L. Hartshorn. The "Chemical News" gives the following abstract of the communication: It is well known that when gas discharges through an orifice from a vessel in which the pressure is p_0 into one in which it is p_1, the rate of discharge is approximately constant from $p_1=0$ upwards to some critical value. But then as p_1 further increases, the discharge falls off, slowly at first, afterwards with greater rapidity. In the present investigation, this phenomenon is examined with greater accuracy than has hitherto been obtained. The pressure p_0 was constant and nearly equal to the atmospheric pressure. The recipient vessel was partially exhausted; the flow of air being maintained by a powerful air-pump. Variations in the flow were detected by slightly choking the entrance to the discharging vessel, and then observing the changes in the pressure-drop due to the choking. Nozzles of various shapes were used. In every case it was found that the flow was constant to at least one part in 10,000 for a considerable range of p_1. The critical value of p_1 at which the flow began to change, varied widely for different nozzles—being about $0{\cdot}2\,p_0$ for the convergent and parallel ones, but as high as $0{\cdot}7\,p_0$ for certain divergent ones. Thus the theoretical value for convergent nozzles—$0{\cdot}527\,p_0$—cannot be accepted as applying even approximately to all nozzles.

Testing the Heat Evolved by Oxide of Iron during Revivification.

The Connelly Iron Sponge Company, of America, have introduced a simple apparatus for testing the amount of heat evolved during the revivification of spent oxide, consisting of two iron cylinders, about half-gallon size, connected at the base, and fitted with a gas inlet and outlet respectively near the top. The only other openings are holes 2½ in. diameter in the centre of the top, which can be closed with large rubber plugs, through each of which is passed the stem of a thermometer. The first is filled with fine wood shavings, to absorb tarry matter and moisture, and the second, which is jacketed with ½ in. of hair felt to reduce heat radiation, receives a sample of the material to be tested. The plugs are then firmly fixed in place, and a stream of unpurified gas is passed through, until the oxide is completely fouled. The gas supply is then disconnected, a small hand blower or bellows attached to the inlet, and a stream of air slowly passed. The second thermometer soon shows a rise in temperature as compared with the first, caused by the heating of the oxide during revivification; and a maximum is reached in about 15 min. The quantity of air passed and the maximum temperature, together with the amount of gas required to saturate the oxide, furnish useful indications of the results that may be expected in actual practice, as well as of the practicability of safe revivification of the oxide *in situ*.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Higher Temperatures and Steaming.

SIR,—I now ask you, as a last favour for the time being, to publish in your next issue my promised results of several experiments made with the Wigan Arley Mine coals.

It will be seen by the analyses of these coals that they have turned out practically of the same quality as formerly. When ordering these coals, I asked the Colliery Company not to let them contain any more foreign matter than in pre-war times; and they loyally complied with my request. It appears to me that if they can oblige in this way, so can all the other collieries.

After the reading of Mr. Blundell's paper before the Manchester Institution of Gas Engineers, several of the engineers who took part in the discussion endeavoured (very properly) to ascertain to what the large increased volume of gas was particularly due. Some thought it was partly due to the better heating of the retorts combined with an additional volume by steaming for making blue-water gas.

I have made quite a number of experiments, especially with two kinds of coal, both at the present time and on former occasions—the latter being made by Dr. H. G. Colman—so I am able to compare them side by side with our recent experiments. These, I think, will interest your readers, and more clearly elucidate this important question. I show the respective volumes of gas due to the better heating and steaming for making blue-water gas.

These several tests indicate the great flexibility and complete control we have over the speeds and regulation of the vertical retorts; and it is interesting to note that, although there was a very considerable reduction and saving in the weight of coal carbonized per retort per 24 hours between the two steaming experiments, the volume of gas per retort was fully maintained with the larger yield per ton of coal carbonized.

JOHN WEST.

Southport, Dec. 20, 1917.

The Testing and Adjusting of Pyrometers.

SIR,—With reference to the paragraph in your issue of the 4th inst., referring to the suggested method of testing pyrometers, I think your readers should be cautioned that a depth of ½ in. of salt is not sufficient to secure a sharp "freeze point." At least three times this depth would be essential, even with a thermocouple having bare wires and without having any outer sheath. Of course, if an outer sheath or tube is used, then a proportionally greater depth of insertion would be given, in order that conduction errors do not enter materially into the reading.

I note that in the method suggested by the Brown Instrument Company it is proposed to correct the reading of the whole pyrometer by altering the zero setting. Taking the error in the example shown (wherein the pyrometer read 6° high), the setting of the zero to

TESTS WITH WIGAN ARLEY MINE COALS.

TABLE I.

Test made by Dr. H. G. Colman during 1911, with Setting of eight retorts in the ordinary way, without steam.	Test made by Mr. J. Bond and Mr. J. Irminger, Nov., 1917, with four larger retorts in the ordinary way, with higher temperatures, without steam.	Tests made by Messrs. J. Bond and J. Irminger, Dec., 1917, with four large retorts with high temperatures, with the addition of 25 and 40 lbs. steam, ½ nozzle, for making blue water gas in the same retorts in one operation.	
		25 lbs. Steam.	40 lbs. Steam.
Temperature outside retort (average) 1424° C. (2595° Fahr.)	1424° C. (2595° Fahr.)	1425° C. (2597° Fahr.)	1430° C. (2606° Fahr.)
Coals carbonized . . . . . 53·75 tons	84·7 tons	16·65 tons	17 05 tons
Coals carbonized per 24 hours . . . 20 t. 2 c. 2 q. (eight retorts)	13·75 ,, (four retorts)	14·57 ,, (four retorts)	10·19 ,, (four retorts)
Coals carbonized per 24 hours per retort . . . . . 2 t. 1 c. 1 q.	3·44 tons	3·64 tons	2·55 tons
Total gas made corrected to normal temperature and pressure . . . 689,835 c.ft.	1,228,769 c.ft.	266,196 c.ft.	392,431 c.ft.
Gas made per 24 hours (corrected) . 258,360 ,,	199,597 ,,	232,994 ,,	234,520 ,,
Gas made per ton (corrected) . . . 12,834 ,,	14,507 ,,	15,987 ,,	23,016 ,,
Make of gas per retort per 24 hours . 32,295 ,,	49,899 ,,	58,248 ,,	58,630 ,,
Calorific value . . . . . 573 B.Th.U.	526 B.Th.U.	511 B.Th.U.	453 B.Th.U.
Total B.Th.U. of gas made per ton of coal carbonized 7,353,882	7,630,682	8,169,357	10,439,756
Tar made per ton of coal carbonized (dehydrated) . . . . . 12·9 gallons	16·5 gallons	17·7 gallons	18·8 gallons
Ammoniacal liquor made per ton of coal carbonized (10 oz.) . . . . 34·7 ,,	29·2 ,,	33·0 ,,	44·3 ,,

[The analysis of gas and tar was not made in this case, as this had been done in several previous tests.]

Analysis of Coal—Nov. 12 to 18, 1917.

	P.ct.
Moisture	1·72
Volatile matter	32·07
Ash	5·0

Analysis of Gases.

	P.ct.	P.ct.	P.ct.
CO_2	2·0	3·3	3·4
Hydrocarbons	2·2	2·7	2·2
O	0·3	0·1	*nil*
CO	12·0	14·0	21·3
CH_4	25·4	20·0	17·4
H	50·7	59·3	53·5
N	7·4	0·6	2·2
	100·0	100·0	100·0

Analysis of Tar Dehydrated.

Sp. gr., 1·077.	P.ct.	Sp. gr., 1·09.	P.ct.	Sp. gr., 1·105.	P.ct.
0° to 170° C.	2·3	0° to 170° C.	2	0° to 170° C.	2
170° to 230° C.	18·0	170° to 230° C.	17	170° to 230° C.	16·75
230° to 360° C.	35·8	230° to 360° C.	36	230° to 360° C.	33·75
Pitch	43·9	Pitch . . .	45	Pitch . . .	45·5
	100·0		100		100·0

TABLE II.

TABLE SHOWING THE EXTRA VOLUMES OF GAS RESPECTIVELY WITH ORRELL NUTS AND WIGAN ARLEY MINE COALS BY THE APPLICATION OF HIGHER TEMPERATURES, WITH THE ADDITION OF STEAMING FOR MAKING BLUE WATER GAS IN THE SAME RETORT AT ONE OPERATION.

Orrell Nut Coal.

	Make per Ton, C. Ft.	Increased Volume per Ton, C. Ft.
Test made by Dr. H. G. Colman in 1911, in the ordinary way, without steam . .	12,390 ordinary heats	—
Test made by Messrs. J. Bond and J. Irminger, Nov., 1917, with higher heats, but without steam	14,989 higher heats	2599
Test made by Messrs. J. Bond and J. Irminger, Nov., 1917, with higher heats and the addition of 25 lbs. steam. for making blue water gas	17,759 high heats and 25 lbs. steam.	2770
Do., with 40 lbs. steam	21,684 higher heats and 40 lbs. steam.	6695
Increase of gas per ton due to higher temperatures only. . . .		2599
Increase of gas per ton due to higher temperature and steaming combined (25 lbs. steam)		5369
Increase of gas per ton due to higher temperatures and 40 lbs. steam pressure combined		9294

Wigan Arley Mine Coals.

	Make per Ton, C. Ft.	Increased Volume per Ton, C. Ft.
Test made by Dr. H. G. Colman in 1911, in the ordinary way, without steam . .	12,834 ordinary heats	—
Test made by Messrs. J. Bond and J. Irminger, Dec., 1917, with higher heats, without steam	14,507 high heats	1,673
Tests made by Messrs. J. Bond and J. Irminger, Dec., 1917, with high heat, and the addition of 25 lbs. of steam, for making blue water gas	15,987 high heat and 25 lbs. steam	1,480
Do., 40 lbs. steam	23,016 high heats and 40 lbs. steam.	10,182
Increase of gas per ton due to higher temperatures		1,673
Increase of gas per ton due to higher temperatures and the addition of steam combined (25 lbs. steam)		3,173
Increase of gas per ton due to higher temperature, at 40 lbs. steam pressure combined per ton		10,182

bring the reading down from 1480° to 1474° Fahr. would only make the pyrometer correct at that particular temperature. The error would probably be an error of calibration as between the thermocouple and the indicating instrument; and this would be a percentage error. Therefore the subtraction of 6°, by zero setting at 1480° Fahr., would be twice the amount necessary when the pyrometer was used at a temperature of 740° Fahr.

I should wish to point out that with instruments of good class, of English manufacture, "changes in atmospheric condition, exposures to vibration or a slight jar" are not likely to affect the accuracy of the instrument in the manner which your paragraph suggests as being likely with the American instruments in question.

Letchworth, Herts, Dec. 15, 1917. CHAS. E. FOSTER.

REGISTER OF PATENTS.

Manufacture of Sulphate of Ammonia.—No. 111,309.

EVANS, E. V., and the SOUTH METROPOLITAN GAS COMPANY, of Old Kent Road, S.E.

No. 13,063; Sept. 14, 1916.

The patentees' specification is as follows: By this invention, a substantially white, yet substantially neutral, ammonium sulphate is made by using in the saturator an acid of such dilution that crystallization of the salt does not occur at the temperature of saturation; continuing the passage of the ammoniacal gases until the liquor is slightly alkaline; then filtering the liquor from the saturator at such a temperature that crystallization still does not occur; and finally causing crystallization of the filtered liquor by cooling it, preferably while it is in rapid movement—for instance, by passing it through a cooled system of pipes. The mother liquor from the crystals may be returned to the saturator.

When the demand is for a white ammonium sulphate, the practice hitherto has been to keep the liquor in the saturator acid, so as to avoid precipitation of the various coloured substances which are thrown out of solution as soon as the liquor becomes slightly alkaline. These substances become entangled in the crystals, whether the latter separates in the saturator, as is usual, or after the liquor has left the saturator and has been cooled—a practice which has been proposed In any case, unless the slightly alkaline liquor is filtered hot (as prescribed by the inventors), the sulphate produced is not white. Being formed in an acid liquor, the white sulphate usually made has an acid reaction, which is objectionable. On the other hand, the neutral but coloured sulphate has a lower market value than one which is both white and neutral—such as is produced by this invention by making the liquor slightly alkaline and filtering before crystallization.

In Näef's specification (No. 13,302 of 1901) a procedure is described which apparently produces a hot neutral liquor in the saturator. This liquor is cooled, while in movement, to crystallize the sulphate, after it has left the saturator, and preferably after all oily matter has been separated, which may be done by filtering. Such procedure would not produce a white, neutral ammonium sulphate—it being essential for this purpose that the saturator liquor should be slightly alkaline before it is filtered.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 19.]

Nos. 18,250—18,701.

APPS, H. S.—"Supplying to internal combustion engines a mixture of gas and air." No. 18,701.

BLAIR, CAMPBELL, AND M'LEAN.—"Mechanical retorts for destructive distillation of sawdust, &c. No. 18,478.

BROWN, T. T.—"Controlling removal of branch-pieces from pipes." No. 18,362.

BUCKINGHAM, E. J.—"Coal-gas carburettor, compressor, and container for motor-vehicles." No. 18,332.

CORNER, E. P.—See Blair. No. 18,478.

ENGLAND, A.—"Gasifying hydrocarbons." No. 18,315.

GUNNIS, R. G. S.—See Apps. No. 18,701.

HARGER, J.—"Regulating flow of liquids." No. 18,331.

HARRIS, G. H.—"Gas-pressure regulating and controlling devices." No. 18,426.

IONIDES, A. C.—"Proportioning combustible gaseous mixtures." No. 18,508.

KEY, J. T.—"Distillation or carbonization of coal and cannel." No. 18,578.

KING, C. F. L.—"Liquid meters." No. 18,563.

MUIRHEAD, W.—"Gas-fires, &c." No. 18,323.

PARKINSON, W. W., and PARKINSON AND W. & B. COWAN.—"Supply and measurement of gas to gas-bags for motors." No. 18,373.

PATTISON, C. M.—"Generating combustion products under pressure." No. 18,262.

ROSS, J. K.—See Blair. No. 18,478.

STUBBS, G.—"Stoves using gas or oil." No. 18,276.

TAYLOR, G. H.—"Regulating the supply of coal gas, &c., to internal combustion engines." No. 18,647.

THOMPSON, H. A.—See Brown. No. 18,362.

TOWERS, J. W.—"Regulating the flow of liquids." No. 18,331.

WAITE, J. N.—"Gas-lighters." No. 18,278.

Price of Gas at Southend.—The Corporation have received from the Southend Gas Company notice of their intention to increase the price of gas from the next meter-reading by 3d. per 1000 c.ft.

LEGAL INTELLIGENCE.

PREFERENTIAL CHARGES FOR ELECTRICITY.

APPEAL AGAINST THE HACKNEY JUDGMENT.

The Attorney-General (at the Relation of the Gas Light and Coke Company) v. The Metropolitan Borough of Hackney.

Judgment was given in the Supreme Court of Judicature, Court of Appeal, last Tuesday by Lords Justices SWINFEN EADY, WARRINGTON, and SCRUTTON in the appeal by the Gas Light and Coke Company from the decision of Mr. Justice Astbury, dismissing the action with costs. Their Lordships unanimously dismissed the appeal with costs. A report of the hearing of the appeal was given in the "JOURNAL" for Dec. 4 and 11, pp. 470, 511.

The Judgment.

Lord Justice SWINFEN EADY: The relators complain that the defendants, who are empowered to supply electrical energy within their district, are committing breaches of sections 19 and 20 of the Electric Lighting Act, 1882. They complain that the defendants are supplying electrical energy for lighting on different terms instead of the same terms to persons taking, under similar circumstances, a corresponding supply, contrary to section 19. They also complain that the defendants are showing undue preference to persons taking current for lighting who also take it for power, contrary to section 20. Mr. Justice Astbury decided that the relators had failed to give any breach by the defendants of the statutory provisions, and dismissed the action and the relators' appeal. The scale of charges of which they complain is set out in paragraph 5 of the statement of claim, and was contained in a circular issued by the defendants in July, 1914. The scale is as follows: "For Lighting—Alternative No. 1. For any quantity of electrical energy used each quarter, not exceeding the equivalent of one hour's supply per day at the maximum demand, 6d. per unit. For any further quantity of electrical energy used each quarter, 1d. per unit." Then there is Alternative No. 2, about which no question arises. "For any quantity of electrical energy used each quarter, 3½d. per unit." Then Scale B is: "For power.—Alternative No. 1. A fixed charge of £1 per quarter per kilowatt of maximum power demanded, and a charge for electrical energy used of ½d. per unit." Then there is this memorandum: "Consumers paying under this scale are allowed to use 20 p.ct. of the energy consumed for lighting." Then there is an alternative No. 2 also, in this case for power, about which no question arises: "For any quantity of electrical energy used each quarter, 1½d. per unit." In October, 1916, and before the issue of the writ, the defendants issued a further circular, in which they explained that customers paying under the B.1 scale for power were allowed to use not exceeding 20 p.ct. of the total quantity of energy consumed for lighting the factory or workshop premises in which the motors are installed, provided that the whole supply is taken from the same service meter. The action proceeded below upon the footing that the terms offered by the defendants were the terms in the first circular, as explained by the second, and that the purpose for which light could be used under the B.1 scale was limited to lighting the place for which energy for power was also being taken, and that the supply for both purposes should be taken through one and the same meter, without a separate circuit for the supply of light. The plaintiffs do not make any complaint as to defendants' charges for energy for lighting under Paragraph A, or for power alone under Paragraph B. Their complaint is limited to the provision enabling power users, taking current under B.1, to consume up to 20 p.ct. of the energy so taken in lighting their factories. The substance of the plaintiffs' complaint can be put in very few words. They say that if two customers take from the defendants energy for lighting under what they allege to be similar circumstances—as, for instance, if two customers take current for lighting their factories, and one has steam or gas engine motive power and the other takes from defendants' electric current for his motive power, the latter is able to obtain his lighting at a cheaper rate than the former. The plaintiffs contend that in such case both customers take energy for lighting under similar circumstances, and ought to be charged at the same rate for such energy. The defendants dispute that both customers take current under similar circumstances, and contend that the customer who takes one combined supply for light and power—who takes at least four units for power for each unit for light—is a better customer for the electric station, and takes energy under different circumstances from one who takes for lighting only. The plaintiffs' contention is that the defendants ought to have a third scale—namely, an intermediate scale between A and B—for customers who use current for light and power, higher than the scale charged to power users only, and lower than the scale charged to light users only. In approaching the consideration of the matter in dispute, it must be borne in mind that customers affect the central supply station differently, according to the different circumstances under which they take current. The purpose for which current is taken is immaterial, except so far as the station is affected by the amount taken, and the circumstances under which it is taken. An ideally perfect customer would be one whose maximum demand on the station was also his minimum, and whose load remained constant, and endured for each hour of the twenty-four, and throughout the whole year of 8760 hours—365 days multiplied by 24 hours. The proportion which the number of units actually sold to any customer during the year bears to the number of units which would have been sold to him if his maximum demand had remained constant throughout the year, is the "load factor" of the customer for that year. It is to the advantage of the electric light undertaking to have customers for energy during the day; so that when its plant is not being used to supply energy for light, it may still be employed in an earning capacity by supplying energy for power. The plant must be capable of meeting the maximum demand upon it at any moment of the 24 hours, and the less the demands made by

different customers synchronize, and the more evenly the aggregate demand of customers is spread over the twenty-four hours, the smaller will be the size of the plant required to meet the maximum demand. What is termed the "diversity factor" is the proportion which the sum of the customers' maximum loads bears to the load actually observed at the station; and this depends upon how far the demands of customers are coincident—the less customers' demands coincide, the better for the station. Speaking generally, it is agreed that customers for power have a better "load factor" and more favourably affect the "diversity factor" of the station than customers for light. Their "load factor" is better, as the number of units consumed by them bears a high ratio to their maximum demand. Indeed, a figure of 25, or 25 p.ct., was accepted as a general figure of "load factor" for power users—meaning that such a person would generally actually take about 25 p.ct., or one-quarter of the quantity which he would take if his maximum demand were continual throughout the twenty-four hours for the entire year. The general figure given as the "load factor" of light users was 12·5. Again, the "diversity factor" of the station is, speaking generally, more favourably affected by power users than by light users. There is great coincidence of demand among various light users, who, speaking very generally, require light when darkness comes on, and not before, and use it for about the same number of hours. With power users, on the contrary, there is much greater difference, *inter se*, as to their hours of work and the times when their maximum demand for power arises; and this smaller coincidence assists the power station. It is essential to bear in mind the effect of the "load factor" and the "diversity factor" on the working of an electric undertaking when considering the scale of charges. It appears that defendants' charge under Scale A 1 for lighting is nearly double the charge under B 1 for power. Under A 1, if the unit be taken at 5d. for the purpose of calculating the cost of one hour's supply at maximum demand, and then all current consumed be charged at 1d. per unit, the annual charge per kilowatt of maximum demand will be £7 11s. 8d. That is to say, four quarters multiplied by 91 day-hours, at 5d. per unit, as against the fixed charge of £4 per year per kilowatt for power. And the charge for current will be 1d. per unit for lighting and ½d. per unit for power. No complaint is made of these charges, if enforced for light only or power only, as the case may be. It is now necessary to consider the position of a power consumer who is allowed to use for lighting 20 p.ct. of the energy he takes. Sir John Snell, the Electrical Engineer called by the plaintiffs, agreed that, in so far as a power user consumes for lighting 20 p.ct. of the current taken, his load factor is rendered worse than if he used all current taken for power alone, and that, as a class, a power user, although consuming 20 p.ct. of current for light, has a better load factor, a better diversity factor, and is a better customer than one taking only current for light; and he concurred in the view that the average price which should be paid by a consumer taking current for power and using part of it for light, should be higher than is paid by a customer taking current for power only, and lower than is paid by a customer taking current for light only. The defendants point out that this is the effect of their automatic scale, and that, in proportion as the load factor of a power user is rendered worse by his taking current for light, to this extent will he pay at a higher rate for all energy consumed, as the worse his load factor the higher the rate at which he pays for current taken. The table put in by Mr. Merz shows how this works out in the hypothetical instance taken. Exactly in the proportion in which the load factor becomes worse, the smaller is the relative quantity of current over which the fixed charge has to be spread; and, accordingly, the cost per unit of current consumed rises in proportion. Down to this point, I do not understand that the plaintiffs dispute the position. But they contend that this result is arrived at without considering another element—viz., the diversity factor; and they urge that if a customer taking power only has a similar load factor to the customer who uses current for both purposes, they will both be charged at the same rate for all current taken, although, by reason of the latter customer adversely affecting the diversity factor of the station, he will be a worse customer than the one with the same load factor taking for power only. At most, it comes to this—that, given two power users, with the same load factor, one only using current for lighting, they pay at the same rate; and thus it is said lighting is given at a cheaper rate than if supplied to a customer taking current for lighting only. No doubt it is. In my opinion, however, a customer who takes current for power as well as lighting, being a more beneficial customer to the undertaking, and taking at least four units for power for every unit for lighting, cannot be said to be taking a supply under similar circumstances to a customer who takes for lighting only. Indeed, the appellants conceded in argument that such two customers might be charged at different rates. What seemed to be the plaintiffs' real grievance is, not that two light users are charged at different rates, but that two power users are charged at the same rate, through each having the same load factor, although one also uses part of his current for lighting. Mr. Colefax criticized the use which the defendants' Counsel make of the table C.H.M. 1, and the way they dealt with it in argument. He contended that the table really takes no account of the diversity factor, but merely shows that every power user pays according to his load factor (neither more nor less), because the difference of load factor is taken into account in the method of charging. It must be remembered, however, that we start with this—that using current for light as well as power renders worse the load factor. If, therefore, two power users have the same load factor, although one uses current for light, it follows that, without using current for light, they would have had different load factors, and as such would have been charged at different rates if worked out per unit per consumer. It is only by reason of one of these customers also taking current for light, and so adversely affecting his load factor, that he is reduced to the same level of charge as the other customer who has a worse load factor than his own for power only. The effect of the sliding-scale is that it does, in fact, introduce and adjust a third scale for power and light combined—the charge being higher than would have been the charge for power only, and lower than would have been the charge for light only. The appellants have, in my opinion, failed to show any breach by the defendants of either section 19 or 20 of the Act of 1882. The case of *The Attorney-General v. Long Eaton Urban District Council* (1914, II. Chancery, p. 251) and on appeal (1915, I. Chancery, p. 124) is clearly distinguishable from the present. In that case, where power and light were both taken, the charge was at a lower rate than when power only was taken, although the consumer was not so good a customer to the station. Again, a difference was made when partial lighting only was taken, so that if any lighting was obtained from any other source, the higher rate was charged. The Long Eaton case cannot govern the present one. In my opinion, the appeal fails, and should be dismissed.

Lords Justices WARRINGTON and SCRUTTON gave judgment to the same effect.

Monazite Sand Control.

In the Chancery Division of the High Court of Justice, last Wednesday, Mr. Justice Younger dismissed with costs the action in which Messrs. Jaeger Bros., Ltd., of Middlesbrough, claimed a declaration that, under an agreement, the Travancore Minerals Company, Ltd., were bound to supply them with 1500 tons of monazite sand for delivery between 1918 and 1922, and that they were to have the sole right of selling this sand in the United States. They further asked for an injunction restraining the defendants from selling this monazite sand in the United States, or from communicating directly with the Lindsay Light Company, of Chicago, or with any other person in America relative to the sale of this sand [*ante*, p. 565]. The Travancore Company entered into an agreement with the plaintiffs and Messrs. Phillip Bauer & Co., of Hamburg, by which plaintiffs and Bauers were to be the sole selling agents for the defendants in Germany. On the outbreak of war, the defendants asked the plaintiffs to obtain another market; and, with the help of Messrs. Phillip Bauer and Co., of New York, they secured the American market. When Messrs. Phillip Bauer & Co., of New York, were placed on the British statutory black list, the plaintiffs transferred their consignments to the Lindsay Light Company. The defences were that there was no completed contract between the parties to the action. There were negotiations, which did not result in a contract. His Lordship said that, after carefully going through the evidence, he was convinced it had not been shown that there was any such contract as the Court could enforce. There was no definite binding agreement upon which the present action could be maintained.

Gas Company Summoned.

The Ogley Hay and Brownhills Gas Company were summoned at the Lichfield Police Court last Wednesday by Dr. H. Wolnerson and four other consumers for not providing apparatus for testing the quality of the gas produced. The prosecution, it was stated by Mr. J. H. Addison (solicitor), had been taken owing to the poor quality of the gas. In instituting the proceedings, the five consumers were not acting in a vindictive spirit, but in the public interests. Mr. Norman Cresswell said there was no meter for measuring the gas at the works, and other things necessary for testing purposes were not provided. Mr. Gosling, who defended, argued that, in view of the demands made upon gas companies by the Ministry of Munitions, this Government Department had urged that the companies should not be penalized through supplying gas of an inferior quality, and also that the authorities should refrain from making tests during the war. The Bench dismissed the case; the Chairman remarking that they had come to this decision in view of the strict injunctions issued to gas companies by the Ministry of Munitions. He suggested, however, that the station meter should be put in order as soon as possible.

The Stanton Ironworks Company, Ltd.

With a view to centralizing their business in London, the above Company have opened an office at Maxwell House, Arundel Street, Strand, W.C. 2; and matters relating to their coal and cast-iron foundry business will be dealt with at this office. The foundry agency arrangement which has existed for many years past between the Company and Messrs. Beck & Co., Ltd., is being terminated at the end of this year; and after Dec. 31 all communications with reference to castings should be forwarded to the Company at the above address. Their telegraphic address is "Cobbles Eastrand London;" and the telephone number "Central 6808." Mr. Arnold Longden, who has represented the Company for some years on the London Coal Exchange, will, during the period of the year, supervise the foundry section of the business in addition to the coal business.

Swansea Corporation and the Gas Company's Bill.—The Swansea General Purposes Committee have resolved that the Council be recommended to oppose the Swansea Gas Company's Bill, with a view to protecting the interests of gas consumers; to co-operate with the recently formed Association of authorities not owning gas undertakings in the matter generally; and to retain the services of Mr. Honoratus Lloyd, K.C., as Counsel for the Corporation.

Position of the British Dye Industry.—Addressing the shareholders of Messrs. Levinstein, Ltd., Sir John Lonsdale said that, roused by the very grave situation created by the pre-war dependence on Germany for dyestuffs, the Government took action early in 1915. The intention underlying their ideas was excellent; but unfortunately the amalgamation and pooling of resources, research, and knowledge that were originally proposed had not so far been achieved. British Dyes, Ltd., had been created; but the investment of £2,000,000 of public money had not solved the problem of ensuring adequate supplies of British-made dyes. Some fifteen months ago, a Joint Committee of the Dye Makers and Dye Users drew up a list of the essential dyes required for the maintenance of our textile trades; but no organized effort of a national character had yet been made to produce these dyes in this country. Without State assistance, no private firm could, under war conditions, carry out the programme for dyes.

MISCELLANEOUS NEWS.

CONSERVATION OF COAL.

Sub-Committee's Recommendations.

An interim report of the Coal Conservation Sub-Committee of the Ministry of Reconstruction, dealing with the extent to which conservation of coal could effect economy in the production of motive power and other forms of energy and for industrial purposes in this country, with the expansion of industry which should result in the way of new manufactures from the proper use of coal so saved, and with the steps necessary to attain these objects, is now in the printers' hands, and will shortly be published; but in view of premature publication having taken place of its contents, a proof has been sent out of the recommendations with which the report concludes. It may be pointed out that the members of the Sub-Committee were: Mr. Charles H. Merz, Prof. W. A. Bone, Mr. Guy Calthrop, Mr. John Kemp, Sir R. A. S. Redmayne, and Mr. Charles P. Sparks. A Board of Trade Committee are also dealing with the problem of electric power supply.

(1) It is essential that the present inefficient system of over 600 districts should be superseded by a comprehensive system in which Great Britain is divided into some sixteen districts, in each of which there should be one authority dealing with all the generation and main distribution.

(2) Centres, or sites, suitable for electric generating purposes should at once be chosen on important waterways, as the future main centres of supply for each of the districts into which the country is to be divided.

(3) The sites so chosen should be as large as possible, having in view the land available in suitable localities, and should have ample water and transport facilities. Land is required not only for the power stations themselves—which, for the sake of security and safety, would have to be suitably subdivided—that is, they would not be contained all in one building, but for the processes involved in the extraction of bye-products from the coal before it is used for the production of power, where such extraction is found to be justified. It is also required for the development of electro-chemical processes, which may be most conveniently carried on in close proximity to the power plant. This condition entails the sites being chosen outside, not inside, towns. [The health of the great industrial centres and the congestion of the railway lines in their neighbourhood would be radically improved by arranging that the conversion of coal into motive power was carried out away from the densely populated centres.]

(4) Plans should be prepared for the construction immediately after the war on these sites of the first instalment of large super-power plants capable, first, of supplying through a comprehensive electric power distribution system, which must also be arranged for, the existing demands of the community; and, secondly, of supplying electrical energy at the lowest possible price for new processes and manufactures.

(5) Such plants would be designed so that, as methods are perfected for extracting bye-products from the fuel, before using it for the purpose of the production of electric power, the bye-product plant can be combined with the power plant. Each site should be laid out with this in view, and with a view to the unrestricted extensions of the plant as required.

(6) Power available from surplus gas or waste heat should be turned into electrical energy on the spot in local plants which would feed into the main distribution system. As regards waste coal—*i.e.*, coal which it does not at present pay to bring to the surface—this could, where transport was the ruling consideration, also be used on the spot.

(7) Once these plants are in existence, it would be possible for existing authorities, without any risk of being left in the lurch, to stop extensions of their own uneconomical stations, situated as they mostly are on cramped and unsuitable sites, and to arrange to take their power from the main system.

(8) With a view to carrying out the policy advocated, a Board of Electricity Commissioners should be appointed, with full powers to deal with the electricity supply situation throughout the country. They should have power, *inter alia*:

(*a*) To stop the extension or multiplication of uneconomical stations for public supply.

(*b*) To arrange for the handing over, on equitable terms, of the generation, transmission, and main distribution system in each of the areas into which the country is to be divided, to a new electricity body appointed for that area.

(*c*) To standardize for each area the frequency and voltage of the main transmission and distribution system.

(*d*) To settle for each area whether such body should consist of a parliamentary company working under adequate control as regards limitation of dividends, &c., or one of the other alternatives given in an appendix.

(9) Alternative types of the new electric power organizations are described in an appendix. In reference to these alternative types, the Sub-Committee are impressed with the special need for initiative and resource in the management of the business of power supply; and they are of the opinion that the freedom of range and keenness which are distinctive of private enterprise will be found to be in a high degree conducive to the fullest measure of success. The Sub-Committee consider that if the nation is to get immediately an efficient power supply, and is to take advantage of the temporary lull in manufacturing output immediately after the war, State assistance in some form may be necessary.

The workmen employed by the Newcastle and Gateshead Gas Company have raised by weekly contributions during the past year the sum of £294 in aid of the local medical charities.

ECONOMY IN CONSUMPTION CALLED FOR.

A notice issued towards the end of last week to the consumers of the Gas Light and Coke Company (signed by Mr. D. Milne Watson, the Managing-Director) states that, in view of the greatly increased demand for gas for munition works and the unprecedented growth in its use for industrial and domestic purposes, and in view also of the restriction in the supply of gas in the Company's area by reason of the impossibility, owing to the war, of obtaining the delivery of plant for gas making (aggravated by occasional stoppages of manufacture due to circumstances beyond control, and by the shortage of labour), it is imperative, in order that urgent munition work should not be stopped, that everyone should immediately, and for the next few weeks, exercise the greatest possible economy in the use of gas. If every consumer would reduce to the utmost the number of burners and fires lighted, the gas available would give much better results, owing to the better pressure that could be maintained. Notice will be given immediately the Company are in a position to resume unrestricted supply.

In an interview with a representative of the "Daily Telegraph," Mr. Milne Watson said that serious difficulties are experienced in maintaining the supply to customers; and he gave reasons why everybody should, from motives of patriotism, reduce the consumption of gas in the home to the lowest possible level. The position in which the Company find themselves at the present time is that of trying to satisfy an abnormal demand with a restricted output. The increased demand is due to the fact that, owing to the shortage of coal, tens of thousands of additional gas appliances for cooking, heating, and hot water supply have been installed. A more important factor, however, is the enormous and growing consumption in munition works and factories of all kinds, and in hospitals, nursing homes, huts, and war establishments generally. Various causes operate to restrict the output—non-delivery of additional plant, a poorer quality of coal, and scarcity of labour being among the number. Economy is imperative in every household unless essential war work is to be hindered. It is estimated that there has been a 20 p.ct. increase in the domestic consumption of gas; and if everybody would save to the extent of one-fifth of the quantity now used, the situation would be eased. Mr. Milne Watson gave the following hints: Hot water should be regarded for all purposes not absolutely essential as a luxury; no gas-burner should be left alight for a moment longer than is absolutely necessary; the utmost economy should be observed in cooking; and the number of rooms heated by gas should be as few as possible. If all waste were eliminated, the Company would be able to maintain a full pressure in the pipes—there are many grumbles on this score at the present time—and the gas used would do its work far more economically. Abundant supplies of coke are available. Our contemporary goes on to say that gas companies are almost embarrassed by the size of the stocks which have accumulated at their works; and as it is claimed that the calarific value of a ton of coke is equal to that of a ton of coal, it is suggested that the public might well make freer use of it for heating purposes. There is no hint at present that gas consumers will be rationed, as, for example, they are in one country, where people are charged a moderate price for the gas they consume up to 50 p.ct. of their pre-war requirements and a prohibitive price for all they use above this quantity. Economy is all that is asked of them.

THE GAS LIGHT AND COKE COMPANY AND CO-PARTNERSHIP.

The co-partnership report for the year to June 30 last of the Gas Light and Coke Company states that the number of co-partners has declined from 9356 to 9211, owing to the continuous demands of the military authorities for more men for the army. Co-partners serving with the forces participate in the bonus as fully as if they were discharging their duties with the Company.

The bonus was at the rate of 1 p.ct. for the nine months to March 31; the total amount divisible being £7040. The raising of the price of gas as from that date resulted in the disappearance of the bonus for the time being. Thus the average rate over the whole year is the lowest since the inception of the scheme in 1909—namely, ¾ p.ct.—but the stringency caused by the international situation which prejudices both consumers and shareholders cannot be expected to leave co-partners unaffected.

The amounts withdrawn from the withdrawable account again show a decrease over the previous year's figure (from £11,647 to £8600). During the year, the sum of £1845 has been transferred from the withdrawable account to the trust account, and £781 has been deposited in cash, thus enabling the Trustees to allot £10,955 of stock at an outlay of £8764. Co-partners have now an interest in the Company amounting to £219,462. Of this, £70,470 represents the aggregate balance of their withdrawable and trust accounts, and the remainder represents £156,620 of stock.

Economy Requested at Smethwick.—Presenting a report relating to the gas undertaking to the Smethwick Town Council, Alderman Pinkney said the time had arrived when there must be the strictest economy in the use of gas for domestic purposes. It was decided to increase the price to all ordinary consumers by 3d. per 1000 c.ft.

Newton-in-Makerfield Maximum Price Application.—An inquiry was held last week by Mr. R. C. Maxwell, on behalf of the Local Government Board, into an application by the Newton-in-Makerfield Urban District Council for a Provisional Order to raise from 3s. to 4s. per 1000 c.ft. the figure above which the Council are precluded from applying gas profits in relief of the rates. There was some objection to the principle of thus relieving rates; but this the Inspector declined to discuss.

CO-PARTNERSHIP UNDER WAR CONDITIONS.

Wishing, through the pages of the "Co-Partnership Journal of the South Metropolitan Gas Company," happiness in 1918 to all the co-partners—not forgetting the women and their teachers—Mr. Charles Carpenter, D.Sc., the Chairman, says:

It may be news, even to many co-partners, that probably no "essential" industry has been so heavily hit by the war as that of gas supply. While, on the one hand, we have to pay a very high price for coal and freight, we do not get a corresponding advantage in the prices obtained for the residual products. So it comes about that the gas consumer of London is taxed to cheapen fertilizers needed for the food production of the nation as a whole. These and other such causes result in the Gas Company's employee being now no better off on a Friday night than his brother working in neighbouring factories. For the time being, the co-partnership bonus, after being in existence for twenty-eight years, has ceased. By reason of war conditions, the Company have no prosperity, and therefore cannot share it under co-partnership principles. The day will come when it will return; but that day is not in sight. Yet, though the bonus has gone, our co-partnership remains. As employer and employee, we understand each other better than at any period in our history. And, after all, money, although a necessity, is not everything; the certainty of fair treatment is a factor not likely to be forgotton.

Happily, amid the gloom of war there has come some light which only shines by contrast. Perhaps the brightest which has helped us during the last year has been the increasing alacrity with which woman is sharing man's labour, and its dangers. There are now employed by this undertaking upwards of 2000 female workers in all grades, from clerks to stokers. The country owes them a deep debt of gratitude for coming to help in the gravest hours of her trial; and the indebtedness must be extended to those men who have so ably, and so patiently, taught them duties of an unimaginable diversity and complexity.

On the "Co-Partnership Almanac" for 1918, below the portrait of the late Sir George Livesey, it is stated that the number of co-partners who have gone from the South Metropolitan Company's service for the defence of the realm up to December, 1917, is 3214. The war fund gives help to 1244 wives and parents, and 2401 children, and expends about £570 per week in such grants. Casualties among co-partners include 240 deaths, 443 wounded, 27 taken prisoners, and 11 missing.

CROYDON CO-PARTNERSHIP SCHEME.

The Croydon Gas Company Co-Partnership Commlttee, in their report on the working of the scheme for the year ended March 31 last, state that the bonus is at the rate of ¾ p.ct. from April 1 to June 30, the increase in the price of gas from April 1, 1916, involving, under the scale, the reduction of the bonus to this rate. From that date, the bonus ceased to be payable. As from April 1, 1917, however, the Directors, having regard to the abnormal circumstances, which could not have been foreseen when the co-partnership scheme was inaugurated, have decided that, irrespective of the price of gas, there shall be a minimum bonus of 4 p.ct. They have also established, as from the same date, a pension fund worked in conjunction with the co-partnership scheme. This will, ten years hence, ensure a pension for all co-partners at a rate proportioned to their length of service and rate of wages or salary, with certain other benefits in the event of death or resignation before the pension age is reached. The fund applies to all co-partners who were not members of the existing staff superannuation fund. The Committee desire to express their sense of the great value of the benefits thus assured to co-partners, which will become increasingly apparent in the future. It is proposed to issue the accounts annually, with those of the co-partnership scheme.

Up to March 31, 1917, from the inception of the scheme, 989 co-partnership agreements have been entered into, and 366 have terminated; leaving 623 agreements in force. Of these 623 co-partners, 260 are serving in the forces; but the Directors have decided that the bonus shall continue to be credited to the accounts, as if they were still working for the Company. They are also relieved during their period of war service from payment of the subscriptions to which they would be ordinarily liable to the workmen's sick and burial fund, though their membership of this, with the benefits accruing therefrom, is unaffected. During the year, £772 18s. has been invested by co-partners (through the scheme) in stock of the Company—making a total to date of £13,231 13s. 4d. The number of co-partners who are also stockholders is now 441.

The following table shows the growth of the scheme during the 8¼ years it has been in operation:

—	No. of Co-Partners.	Bonus. Rate.	Bonus. Amount.	Savings.	Interest Credited to Co-Partners' Accounts.	Total Holdings Acquired to Date by Co-Partners through the Scheme.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.
1909 (6 months)	479	3	1,244 15 9 (12 months)	886 15 7	7 13 5	2,106 9 10
1910	499	3	1,305 12 9	1,002 1 2	81 0 8	4,196 17 8
1911	528	4	1,822 16 8	756 13 6	98 11 10	5,780 15 11
1912	554	5	2,695 13 8	774 12 5	103 4 2	7,175 12 11
1913	570	6	2,961 9 4	1,181 18 3	116 14 4	8,727 16 2
1914 (9 months)	628	6	2,382 1 0	899 0 6	109 11 4	8,416 15 7
1915	646	5½	3,113 16 4	1,949 16 7	157 4 8	9,529 2 3
1916	620	2½	1,281 15 7	1,313 0 0	218 17 7	8,176 10 11
1917	623	* ¾	108 18 0	1,324 11 6	245 4 8	6,381 15 10
Total (8¼ years)			16,916 19 1 (8¼ years)	10,088 9 6	1,138 2 8	18,840 11 2

* For three months.

It has been reported to the Committee that up to this date there have been purchased for co-partners over 4300 war savings certificates, through the Association which was formed in connection with the Company in July, 1916.

The Committee are glad to be able again to congratulate the co-partners on the facts that the savings (for 8¼ years) amount to 59 p.ct. of the total credited as bonus, and that (apart from withdrawals arising from co-partners leaving the Company's service) only £7041 has been withdrawn out of a total of £15,810 available for withdrawal.

The report is signed, on behalf of the Co-Partnership Committee, by Mr. Charles Hussey (Chairman).

TOTTENHAM DISTRICT GAS SUPPLY.

The Company's Considered Reply to the Local Authority.

The improvement in the gas supply in the extensive district covered by the Tottenham District Light, Heat, and Power Company has unfortunately, owing to unavoidable war exigencies, been only short-lived, and much criticism has been, and is being, passed by the consumers generally. At the meeting of the Tottenham Urban District Council last Thursday, the considered reply of the Company to questions which were submitted at the Council deputation that recently waited upon the Directors, as reported in the "JOURNAL" last week, was made known. It is as follows:

I now have pleasure in sending you a considered answer to the points raised by the deputation on the 4th instant, the chief of which were as follows:

1.—Did the Company exercise reasonable foresight in making provision to meet the needs of the district?

2.—Was every effort made to obtain the necessary material and labour to properly carry on the work and maintain the supply of gas in the district?

3.—Do the Company suggest that the Council are in any way responsible for the inadequate supply?

4.—Will the Company guarantee that the supply shall in future be entirely satisfactory?

Dealing with the points in order:

1.—As long ago as 1913 large extensions of the works were decided upon, and the drawings prepared. In that year a gasholder tank was started, and a gasholder of 6¾ million c.ft. capacity was ordered. Early in 1914, the tank was finished, and has since been lying idle because the gasholder could not be obtained. At the same time, the new retort-house and complete plant for the manufacture of 4½ million c.ft. of gas per diem was put in hand. Completion was promised in September, 1915; but the plant was only recently finished. It is hoped the plant will be in full working order before the end of this year. In addition to the delay in the extensions, it has been impossible to keep the existing plant in a proper state of repair, owing to the difficulty of laying-off any portion for reinstatements and impossibility of obtaining material and skilled labour. Further, the carburetted gas plant, which in normal times supplied from one-fourth to one-third of the whole output, has been largely robbed of its usefulness, owing to the stoppage of the oil supply.

2.—Every effort has been made by the Company to obtain priority from the Government for necessary materials to enable them to complete the extensions, but without avail, or with very partial success.

3.—My Directors regret that any suggestions should have been made which could have been interpreted as throwing any blame on the Council for the present inadequate supply.

4.—The Company would only be too happy to give a guarantee of a satisfactory supply; but there are so many matters affecting the supply beyond their own control that they cannot give any definite pledge. They can only promise to spare no effort to carry out their obligations to their consumers, and have hopes they will be successful.

My Directors have always been proud of the good reputation of the Company; and they realize how all-important it is for the success of their undertaking that this good reputation should be maintained. In the past the Company has made special efforts to give the consumer every attention, and the results have been that the consumer has relied more and more on his gas supply. The partial failure of this has been a very serious matter to him; and no one deplores this more than my Directors. The whole of the failure is attributable directly to the war. Before the war, the Tottenham Gas Company was envied by its neighbours. The price of gas was for a time the lowest in the South of England, and no district was better served both as to price and attention to consumers. The Company has from the commencement of the war done all in its power to help the Government—perhaps with too little regard for the consumers and the shareholders. We are confident, however, that both consumers and shareholders would—and did, in fact—support the efforts of the Company in this respect. The new section of the works is now partially in action; and there is every reason to hope and expect that the supply will gradually improve, and that the improvement will be maintained.

In conclusion, my Directors wish me to express their appreciation of the temperate and friendly way in which the deputation of the Council put forward their case. They thank the Council and the consumers for the way in which they have borne the undoubted inconvenience due to the shortage of gas supply. Nothing on their part shall be left undone to improve the supply and to maintain the good reputation they have always had in the district.

That the District Council are indignant with the Company is apparent by the discussion which followed the submission of the letter. Speaking to a motion (which was carried) that the reply be added to the minutes "for a very special reason," Mr. Elderfield said the public had been told by the Press that the present serious condition of the supply was in some measure due to some action on the part of the Council; but they now found that no blame could attach to that authority. It was perhaps a little unfortunate that the Press had taken part in the special pleading on behalf of a monopoly which had very sadly failed, and was still failing, to fulfil the very essence of their public responsibility. As regards putting up a pumping station on the public land, and so link the mains with the Gas Light and Coke Company, the Council could in no way consent to give up part of the common land for private purposes to a Company which was trading for profit. There was land adjacent which was easily obtainable by the Company. It seemed strange that while some traders might be summoned because of the difficulty of obtaining supplies, the Gas Company was so administered that the public were often charged for some-

thing which they never received. The question was whether the Council and the public were satisfied with the explanation that the failure of the Company was simply due to the war.

Mr. Hoare said that, with regard to the Company's breakdown of machinery, he took no notice of this whatever, because the Company had always been ready with that excuse; and he was sorry to say the Council had always been ready to accept it. They had taken the pressure that day, and it was under one inch. They wanted at least a 3-in. pressure and 4-in. if they could get it. It seemed to him that all the Company troubled about was getting dividends; and it was about time the Council told them they had had enough of their nonsense, and took proceedings against them to force them to supply to the public that for which they were charged.

A resolution was passed to request the Board of Trade to hold an inquiry.

GAS FOR MOTOR VEHICLES.

Describing a "Simple Roadside Standard," the "Commercial Motor" makes the following remarks on the filling arrangements installed in Birmingham: Birmingham has introduced an interesting type of street standard for roadside supplies to gas-driven vehicles. A valve-controlled standpost is placed near the kerb, together with a small sentry-box-like office for the accommodation of the attendant in charge. The office occupies but little superficies—3 ft. 9 in. by 2 ft. 10 in.—and is set at the back of the footpath, so as to offer the minimum of obstruction. This box is equipped with a small radiator, while there is also installed a clock-driven pressure recorder, which shows on the chart, somewhat reminiscent of that of the barograph, the gas pressure in the main—the calibrations being in tenths of an inch. The cast-iron standpipe is fitted with a 2-in. wrought-iron tee top and a 2-in. connecting pipe about 12 in. in length, carrying an ordinary screw tap. A section of a pneumatic tyre inner tube serves as the flexible junction with the gas-bag connection. At the foot of the standpipe is the controlling valve for the gas supply. The gas pressure in the main varies from 30-10ths to 40-10ths of an inch; while that in the gas-bag averages about 3-10ths. With this supply standard a 250 c.ft. bag can be filled in about five minutes. No meter is used, but, if preferred, one could be installed in the attendant's box. So far as the Midland city is concerned, metering by the roadside is somewhat superfluous. The gas-bags are calibrated at the gas-works upon receiving their initial charge; and their carrying capacity is legibly printed on them. Consequently, subsequent supplies are based upon the registered capacity of the bag. The whole arrangement is very simple and inexpensive, as well as conducing to expedition in charging. The success of this system should popularize the installation of a comparable method in other towns and cities. Roadside gas supplies promise to become pressing; so a universal system should be established.

The Prestatyn Urban District Council have agreed to supply coal gas at 6d. per 100 c.ft., *plus* an attendance charge of 6d. Only vehicles engaged on business service will be supplied.

Mr. C. E. Holt writes calling attention to the fact that the name of the Wilmslow and Alderley Edge Gas Company (of which he is the Engineer and Manager) was not included in the list published in the "JOURNAL" a fortnight ago [p. 518] of those by whom a demand for the filling of gas-containers would be welcomed.

The Hebden Bridge and Mytholmroyd Gas Board have resolved to put down a service meter at the offices for motor power, and that a charge of 6d. per 100 c.ft. be made.

CURRENT SALES OF GAS PRODUCTS.

Tar Products in the Provinces.

Dec. 22.

There is practically no alteration in the markets for tar products.

The average values for gas-works products during the week were: Gas-works coal tar, 26s. 9d. to 30s. 9d. Pitch, East Coast 20s. to 25s. per ton; West Coast—Manchester 18s. 6d. to 19s. 6d., Liverpool 19s. 6d. to 20s. 6d., Clyde 19s. 6d. to 20s. 6d. nominal. Benzol 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 7¾d. to 8¼d. Solvent naphtha, naked, North, 3s. 6d. to 3s. 8d. Heavy naphtha, North, 1s. 8d. to 1s. 10d. Creosote, in bulk, North 3¾d. to 4¼d. Heavy oils, in bulk, North 4¼d. to 4½d. Carbolic acid, 60 p.ct., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s. to 90s., bags included. Anthracene, "A" quality, 3d. per unit; "B" quality, 1½d. to 2d.

Manchester District Tar Prices.

The average price realized for tar in this district, based on the value of the products for the month of November, was 32s. 1d. per ton.

FROM A MARKET CORRESPONDENT.

Tar Products.

There has been very little change in conditions since the last report; the near approach of the Christmas holidays, coupled with the difficulties of transport, having a restrictive influence upon business. London pitch remains at 50s. per ton asked for prompt, although business continues to be put through at about 48s. f.o.b. There is a very fair

SIMMANCE'S
Total Heat Recording Calorimeter

¶ The only Recording Calorimeter which combines a Standard Calorimeter and a Recording device.

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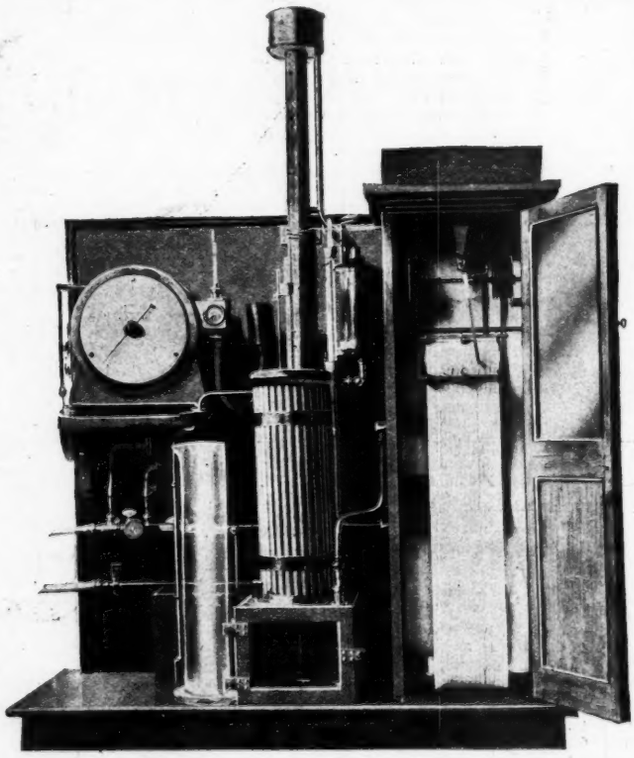

ALEXANDER WRIGHT & CO., LTD.,
1, Westminster Palace Gardens, Artillery Row, Victoria Street, Westminster, S.W. 1.

volume of export trade, and the only difficulty appears to be with regard to shipping facilities—a difficulty which is more acute on the North-East Coast than in London. Provincial centres nevertheless manage to make small exports from time to time, and, generally speaking, in spite of the accumulation of stocks, the position is described as more hopeful. At any rate, holders are unwilling to part with any great quantity of pitch at current rates. Solvent naphtha remains firm at 4s. 6d. per gallon London, and about 3d. cheaper in the Provinces. Heavy naphtha is steady at late rates. Creosote is not much mentioned now; the Government taking most of the output. Although there is a fixed maximum, there is no regular quotation; but it might be possible for private buyers to obtain small supplies at 4d. to 4¼d. per gallon. Cresylic acid maintains its recent firmness; but the price remains at 2s. 9d. per gallon. Benzol and toluol are both nominal, and aniline oil dull at 1s. 2½d. per lb. The scarcity of naphthalenes continues, and difficulty is experienced in covering requirements. Prices, however, are unaltered. Some months ago, it seems, the petrol authorities were asked to sanction the unrestricted use of naphthalene for certain experiments in connection with its use as a motor fuel. The idea, as noted last week, is not a new one, as in 1904 successful researches were made with it in France, followed by further experiments in this country a year later. In the latter instance, naphthalene, in the form of balls, was loaded into a hopper, whence it dropped into a metal box heated by the exhaust from the engine. Air was drawn through the vapour, and the two together fed into the engine. The idea was then abandoned; but for the last five years two gas engineers have made further researches on naphthalene fuel. The results indicate that, though the melting point of naphthalene is 79° to 80° C., an efficient explosive mixture with air is not formed until the temperature reaches 135° C.; and so long as this temperature could be maintained in an exhaust-heated melting box *cum* carburettor, a 10 H.P. American four-cylinder model could be run efficiently at 1000 revolutions under full load.

The range of home quotations is as follows:

Aniline Oil (pure): 1s. 2d. per lb.

Benzol: 90% London, 1s. 0½d., North 10½d. to 11½d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East-and West Coast 3s. 6d. per gallon; crystals 40% 1s. 3d. per lb.

Crude Tar: London 30s. to 35s., Midlands 25s. to 26s.; North 26s. per ton, *ex* works.

Pitch: London 48s. to 50s. f.o.b.; East Coast, 22s. to 24s. f.o.b.; West Coast—Liverpool 22s.; Manchester 22s. to 23s. f.a.s., Clyde 22s. to 24s.

Solvent Naphtha: Naked London 90-190% 3s. to 3s. 3d.; North 2s. 9d. to 3s. per gallon; 90-160% naked London 4s. 3d. to 4s. 6d.; North 4s. to 4s. 3d. per gallon.

Crude Naphtha: Naked 30% 8¼d. to 8½d.; North 6½d. to 6¾d.

Naphthalene: Refined £32 10s. to £35; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 3¾d.; heavy oil, 4¼d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¼d. to 2¼d.

Cresylic Acid: 95%, 2s. 7d.; 97-99%, 2s. 8d. to 2s. 9d. *ex* works London and f.o.b. other ports.

Grease Oils 180 Tw. (naked) £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

There is no alteration in home trade conditions. Buyers postponed their orders in spite of official warnings, and now find much difficulty in obtaining deliveries. The business being taken is consequently mainly for delivery in the New Year. The year about ending has been a somewhat disappointing one from the manufacturers' point of view. Export trade has dwindled almost to vanishing point; and the home trade, although of good volume, has proved practically unremunerative. This would not matter so much were future prospects at all clear. Unfortunately, prospects are not very promising, as the export trade must remain suspended for some time to come, and there is not much chance of obtaining improved terms from the Government in respect of the home trade. If there is one feature of the past year's trade which stands out prominently, it is the results achieved by recent propaganda, which has induced farmers to settle down as staunch and experienced users of sulphate and artificial manures generally to an extent that was scarcely thought likely a few years ago. It seems more than likely that, in well-organized propaganda, accompanied by a properly conducted export sales organization, the future hope of salvation for the trade will be found.

Gas consumers at Doncaster were put to considerable inconvenience last week on account of the low pressure of the gas. The trouble was caused by a big leak in one of the holders. Day and night work is being resorted to in order to remedy the defect.

The Commissioner of Police is forwarding metropolitan local authorities a device by means of which the public might be notified at night as to the direction of the nearest air-raid shelter. It is suggested that the notice should be placed inside the lanterns of the street-lamps nearest to the various shelters. The wording of the notice is "Shelter during Raid," and is accompanied by an indicating arrow.

The gas consumers of Long Preston have been notified that the price of gas will be increased to 8s. per 1000 c.ft.—a rise of 33⅓ p.ct. The East Ardsley Gas Company are raising the price of gas to consumers through ordinary meters 5d. per 1000 c.ft.; while prepayment meter users will receive 18 c.ft. for a penny (instead of 20 c.ft.). The Malton Gas Company announce their intention of raising the price of gas in January from 3s. to 3s. 2d. per 1000 c.ft. The Elland-cum-Greetland Gas Company are advancing their price 4d. per 1000 c.ft. by ordinary meters, and 5d. for the prepayment meter users.

WAR WORK

Has had first place with us since 1914.

We appreciate, however, our customers' needs for "D.S.O." Fires and Gas Steam Radiators. In thanking our many clients for their orders, we would respectfully beg their indulgence if their exact requirements cannot be met at once, and we suggest to save delay that alternate sizes and finishes be accepted where possible.

R. & A. MAIN, LTD.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Increased Price at Exeter.—The Exeter Gas Company announce an increase in the price of gas of 2d. per 1000 c.ft., and also that the charge for all apparatus will be advanced.

Solving the Light Problem.—Letters have been submitted to the Swansea Education Committee from the head teachers of a number of schools, complaining of the poor light given by the gas. The Borough Architect stated that, after trying special burners supplied by the Gas Company, he was of opinion that the lighting could be improved only by providing incandescent fittings, which would probably cost £500 for all the schools. The Committee decided to release the children from school earlier, so that there will be no need for artificial lighting.

Local Authorities and Gas Companies.—In a letter to the Borough Councils of London, the Hon. Clerk of the Metropolitan Boroughs Standing Joint Committee states that the Executive Committee have had under consideration the letter from the Islington Borough Council [*ante*, p. 573], and resolved to recommend the Standing Joint Committee, at the annual meeting on Jan. 28, to make representations to the Board of Trade, urging the Board to strenuously resist the proposals of the gas companies, and to recommend the Metropolitan City and Borough Councils to take similar action.

Belfast and the Calorific Standard.—The Belfast Corporation have given notice of their intention to apply to the Local Government Board for Ireland for an Order under the Gas (Standard of Calorific Power) Act, 1916, to adopt, in respect of their gas undertaking, a calorific standard of 500 B.Th.U. gross per cubic foot.

Bolsover Gas Prices Increased.—The Bolsover Gas Company, Ltd., have decided that from Jan. 1 the price of gas to ordinary consumers will be advanced 6d. per 1000 c.ft. Automatic meters will be altered to give a corresponding return. The Directors state that they are compelled to make this advance in consequence of the Coal Controller's action in raising the price of coal 2s. 6d. per ton, and owing to the large increase in the cost of all materials and wages.

Increased Prices.—The Hipperholme District Council have announced the advance of gas charges, as from the meter reading in December, by 3d. per 1000 c.ft. for all purposes, except in the case of prepayment meters, in respect of which the rebate will be reduced. The Kildwick Gas Company announce that as and from Jan. 1 next a further increase in the price of gas from 3s. 4d. to 3s. 6½d. per 1000 c.ft. for lighting and to 3s. 4d. for heating, cooking, and motive power purposes, will be instituted. The Limavady (co. Londonderry) Urban Council have raised the price of gas for all purposes to 7s. 6d. per 1000 c.ft. from Jan. 1.

STOCK MARKET REPORT.

IN regard to business on the Stock Exchange during the week just concluded, it almost goes without saying that it was even quieter than any of its inactive predecessors. Hardly alive on any of the five days, and with a diminishing attendance, it gradually subsided into a state of lethargic slumber preparatory to a five-day holiday trance from the Friday till next Thursday. Markets in general were weak from sheer inanition, and not from any moving factor. Of these, there was a dearth working either way. Incidents from the fronts were on a minor scale, and not unsatisfactory. The stout resistance of the Italians and the increasing indications of an impending revolution against Bolshevic terrorism were hopeful items, and, on the whole, prices did not weaken immoderately.

The gilt-edged division was rather dull, and Home Government issues gave way. The 5 p.ct. War Loan steadied before the close; but the 3½ p.ct. Consols continued easy. Home Rails were not largely dealt in; but the tone was certainly better. Canadians also, and Argentines, too, were firmer. In the Foreign Market, French was steady, and the new loan made a successful *début*; while Portuguese and Italians were regarded with favour. Among the Miscellaneous group, there were irregular movements. Rubber recovered somewhat on a rise in price of the raw material, and Oil was firm; but Breweries fluctuated.

A unique and noteworthy incident was the gracious visit of the King and Queen to the Stock Exchange on Tuesday, when they were greeted with exuberant manifestations of loyalty and devotion.

Business in the Gas Market was on a reduced scale, and was not remarkable for any salient characteristic. Prices showed hardly any variation from the week before; but some were a shade better, and others a shade worse. Quotations were left standing, with the exception of Liverpool, which advanced a point. The European Company will distribute an interim dividend at the rate of 4s. per share, as against 5s. a year ago.

In the Money Market there was a good demand.

Bargains done for cash during the week were as follows: On Monday, Commercial debenture 53½, Continental Union 39, Gas Light ordinary 68, 68⅛, 68¼, Imperial Continental 89½, 90½, South Metropolitan 76, South Suburban 76, 76⅛. On Tuesday, Gas Light ordinary 67½, ditto preference 71½, ditto 10 p.ct. bonds 175, Hong Kong 7⅜, Imperial Continental 89½, Monte Video 8½. On Wednesday, Alliance and Dublin 54½, Continental Union 39, Gas Light ordinary 67½, 67⅞, 68¼, Imperial Continental 89½, 90, South Metropolitan 76⅛, 76½, South Suburban 76, 76⅛, Wandsworth "A" 100, ditto "B" 80, Ceara debentures 50. On Thursday, Gas Light ordinary 68, ditto 10 p.ct. bonds 174½, 175½, Tottenham "B" 71½, 71⅛, Aldershot 5 p.ct. "C" 70, 70½. On Friday, Commercial 3½ p.ct. 65, 65½, Continental Union 39¼, 40, Gas Light ordinary 68, 68⅛, ditto maximum 57, ditto preference 70½, Hornsey 114, Imperial Continental 88½, South Metropolitan 75¾, 76¼, ditto debenture 56½.

The Bank rate is 5 p.ct., as fixed on April 5.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Shares.	When last Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	57—62	..
1,551,868	"	April 8	2½	4½%	Alliance & Dublin Ord.	59—64	52—57	54⅛
374,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	60—65	..
280,000	5	April 29	7½	3/6	Bombay, Ltd.	5⅞—6⅜	5—5½	..
50,000	10	Feb. 26	16	14%	Bourne-mouth Gas and Water { 10 p.c.	29—30	28—25	..
383,110	10	"	7	7%	B 7 p.c.	15—15½	10½—11	..
115,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	9—9½	..
159,740	—	—	—	4%	4 p.c. Deb.	..	69—71	..
992,045	Stk.	Feb. 26	14	5½%	Brentford A Consolid.	261—266	79—82	..
794,990	"	"	11	4½%	Do. B New	204—209	76—79	..
56,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	81—86	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—93	68—65*	..
217,380	"	Feb. 26	11	10%	Brighton & Hove Orig.	208—213	145—150	..
244,200	"	"	8	7%	Do. A Ord. Stk.	154—159	98—103	..
580,000	20	Mar. 26	12½	22/6	British	44—45	32—33	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	63—70	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	53—56	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	3—3½	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,513,280	"	Feb. 12	5/9/4	44/-	Commercial 4 p.c. Stk.	106—108	70—72	..
560 000	"	"	5½	40/-	Do. 3½ p.c. do.	103—105	64—66	65—65½
475,000	"	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	51—53*	53½
800,000	"	"	4	—	Continental Union Ltd.	76—79	39—41	39—40
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	61—63	..
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	165—175	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	123—125	95—100	..
55.000	"	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,009,180	10	July 29	10	5/0	European, Ltd.	17½—18	10—11	..
16,313.480	Stk.	Feb. 10	4/17/4	87/4	Gas { 4 p.c. Ord.	98—102	67—69	67½—68½
2,600.000	"	"	3½	3½%	Light { 3½ p.c. max.	76—79	56—58	57
4,082,285	"	"	4	4%	and { 4 p.c. Con. Pref.	96—99	70—72	70½—71½
4,674 850	"	June 11	8	8%	Coke { 3 p.c. Con. Deb.	72½—74½	54—56*	..
180,000	"	"	10	10%	10 p.c. Bonds	..	..	174½—175½
268,740	"	Mar. 12	5	3½%	Hastings & St. L. 3½ p.c.	87—89	48—53	..
70.000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16¾	7½—8½	7⅜
86,600	—	—	—	9%	Hornsey 7 p.c.	..	115—125	114
181,000	Stk.	Mar. 12	7½	7%	Ilford A and C.	151—154	92—97	..
65,780	"	"	6⅜	5½%	Do. B	115—118	72—77	..
65.500	"	June 26	4	4%	Do. 4 p.c. Deb.	92—94	65—68	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150—160	89—92	88½—90½
1,235,000	"	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,242	"	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	82—87	..
2,498,905	"	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A / B	211—213 / 146—148	84½—85	..
306,083	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—73	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	3⅝—3¾*	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	89—100	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8—8½	8½
1,875,892	Stk.	July 29	4½	4½%	Newcastle&Gatsh'dCon.	98½—99½	77½—78½	..
529,705	"	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	61—63	..
55,940	10	Feb. 26	7/14/0	7%	North Middlesex 7 p.c.	14—15	9½—10½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	102—104	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	128—131	88—88	..
100,000	50	"	12	11%	Do. C	118—121	73—78	..
52,000	50	"	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	1⅜—2	..
499,980	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅝—5	2½—3	..
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—98	76—78	..
—	—	—	—	4%	Do. " " 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	59—64	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	7½—8	..
125,000	50	July 1	5	5%	5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	..	..
209,984	"	"	10	10%	Do. B	222—224	180- -184	
528.500	"	"	10	10%	Do. C	220—222		
90,000	10	May 28	9	6/-	South African	10½—11½	9—10	..
6,609,895	Stk.	Feb. 10	5/4/0	46/8	South Met. 4 p.c. Ord.	111—113	75—77	75¾—76½
—	—	—	—	—	Do. Pref.	..	94—96	..
1,895,445	"	July 10	8	8%	Do. 3 p.c. Deb.	72½—74½	55—57	56½
224,820	"	Feb. 26	8½	7½%	South Shields Con. Stk.	157—159	137—139	..
952,795	"	"	6	4½%	S'th Suburb'n Ord. 5 p.c.	114—116	75—77	76—76⅜
60,000	"	"	5	5%	Do. 5 p.c. Pref.	110—112	75—77	—
135,000	—	—	—	4½%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	86—88	..
647,740	"	May 14	5	5%	Southampton Ord.	99—102	75—77	..
120,000	"	Feb. 12	7½	5½%	Tottenham { A 5 p.c.	135—138	92—97	..
782,275	"	"	6	4%	District { B 3½ p.c.	115—117	70—72	71½—71⅝
181,255	"	June 26	4	4%	4 p.c. Deb.	87—89	61—63*	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109½	89—91	..
80,000	"	Feb. 26	8½	72/6	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	112—117	100
255,636	"	"	6½	57/6	Do. B 3½ p.c.	129—134	97—99	80
108,075	"	"	5/17/3	50/9	Do. C 3½ p.c.	110—115	84—89	..
352,000	"	"	6½	51/3	Wimbledon 5 p.c.	117—122	85—90	..
98,000	"	"	6½	57/6	Epsom 5 p.c.	121—126	93—98	..
88,416	"	June 26	3	3%	3 p.c. Deb. Stk.	66—69	50—53	..

* Ex Div.

London County Council and the Sliding-Scale.

In the course of a report which the London County Council are circulating among local authorities with reference to the proposals of the gas companies in the matter of the sliding-scale, they say: "The companies base their claim for an amendment of the sliding-scale arrangement on the ground of financial hardship; and though they now only bear one-seventh of the extra charges, they seek to pass on to the consumer 97 p.ct., or practically the whole, of the additional cost due to the war. They are apparently unmindful of the benefits which have accrued to them in the past through the operation of the sliding-scale, which has enabled them to distribute in dividends several millions in excess of the sums they could otherwise have paid. The companies point to the low prices of their securities, which, in their opinion, militate against the raising of further capital on favourable terms. It is true that the prices of the securities of the London Gas Companies are low; but the figures would be very different if the ordinary stocks had not been converted. The altered value of money has affected the prices of all securities; and, in our opinion, the present comparatively low prices of gas stocks furnish no reason for increasing the shareholders' dividends at the expense of the consumers. Whatever new capital has to be raised will probably be obtained by the issue of loan, not ordinary, capital; and therefore the question of the price of the ordinary stocks does not affect the financial operations of the companies during the war." In a report to the Poplar Borough Council, the General Purposes Committee say they are of opinion that there is no justification for the proposal.

Power Gas Corporation, Ltd.

At the annual meeting last Tuesday, Mr. E. Lloyd Pease, who presided, said that at the request of his co-Directors, he had accepted the position of Chairman, which had been rendered vacant by the resignation of Sir Alfred Mond upon accepting office as First Commissioner of Works. He thought they had every reason to be satisfied with the results of the past year's working. The question of the carbonization of coal by methods designed to secure the best return of bye-products was receiving a great amount of serious attention. The Fuel Research Board's report contained a proposal to build a large experimental station for the gasification of coal of all classes under varying conditions, the results of which would be of the greatest interest to the Corporation—there being much to learn upon the treatment of differently graded coal, especially under low-temperature conditions designed to produce the largest quantity of fuel oil. The complex question of making the best use of coal could only be solved by degrees. Meanwhile, the gasification of coal in place of its wasteful combustion was in line with the view taken by the founders of the Corporation. As to the works of Messrs. Ashmore, Benson, Pease & Co., it was originally intended to employ these mainly in the manufacture of recovery gas plant; but, subsequently, the undertaking was widely extended in all directions of constructional engineering, in which they had been enabled to eliminate much of the destructive competition which formerly existed among general engineers. At Dudley Port, another large extension of the central gas distributing station was about to be made; and this would include a further recovery gas plant provided by their South Staffordshire subsidiary.

The Directors of the European Gas Company, Ltd., have decided to pay on Feb. 1 next an interim dividend of 4s. per share, free of income-tax.

Westminster City Council and the Sliding-Scale.—On the recommendation of the General Purposes Committee, the Westminster City Council have decided to write to the Board of Trade urging them to strenuously resist the proposals of the gas companies in the matter of the modification of the sliding-scale.

A Borough Rate at Doncaster.—For the first time in the history of the borough, the Doncaster Corporation have decided, in committee, to levy a borough rate. Owing to serious losses through the abandonment of the town's race meetings, the falling away of gas profits, increased wages, and other causes associated with the war, the borough's funds cannot meet the liabilities; and a rate has become necessary.

Increase in Price by the South Metropolitan Gas Company.—The South Metropolitan Gas Company intimate that it has again become necessary to increase the price of gas, which will be raised for ordinary consumers from 3s. 1d. to 3s. 7d. per 1000 c.ft. from the Christmas meter readings, and for slot-meter consumers in proportion. The Company point out that prices for coal and residual products are now practically controlled and fixed by the Government; and the recent further increases in the cost of coal, freight, and labour have rendered unavoidable the rise in the price of gas.

Price of Gas at Walton-on-Thames.—The Directors of the Walton-on-Thames and Weybridge Gas Company announce that, owing to the continued high freights and the further big rise in coal and labour, they are compelled to raise the price of gas 5d. per 1000 c.ft., as from to-day. This will make the charge 5s. per 1000 c.ft. Consumers are requested to observe the strictest economy in the use of gas during the remaining winter months, as otherwise it may be found necessary to restrict the supply very considerably, in consequence of the shortage of labour and other difficulties incident to war conditions.

Sligo Asylum Lighting.—During a discussion by the Sligo Asylum Management Committee, on the lighting of the institution and negotiations that had been proceeding on the proposed introduction of the Selas system, Mr. Cryan urged that the matter should stand adjourned. They were, he said, entirely in the hands of the Gas Company, who were charging them too high a price for gas. Mr. Tarrant mentioned that he had been told by a representative of the Gas Company that their employees were affiliated with a union in England; and when they asked for an increase, it had to be given. Thus the price of gas had to be raised in proportion. It was decided that the negotiations be continued.

A Sub-Committee of the Bath City Council have been unable to see their way to recommend the Council to accept an invitation to become members of the Association of authorities not owning gas undertakings.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral Countries unless they are posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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In payment of subscriptions for "JOURNALS" sent abroad, Post Office Orders or Bankers' Drafts on London only are accepted.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4.

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Resists 4,500° Fahr. Best for Gas-Works.
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See illustrated Advertisement Feb. 20, p. III. of Centre.

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TRADE MARK AGENTS,
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Telegrams: "Patent London." 'Phone: 248 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
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See Illustrated Advertisement, Nov. 27, p. 437.

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Apply, stating Experience and Wages required, to the MANAGER, Aylesbury Gas Company.

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Apply, by letter, stating Wages required, to No. 6394, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

COUNTY BOROUGH OF BARROW-IN-FURNESS.

THE Corporation invite Applications for the Appointment of CHIEF ASSISTANT to the GAS and WATER-WORKS MANAGER. Commencing Salary, £170 per Annum (with War Bonus), rising, by annual increments of £10, to a maximum of £250; the first of such increments being due on the 1st of January, 1919.

Applicants must be Competent Draughtsmen, and have a thorough knowledge of Gas-Works Routine, Water Collection, Storage and Delivery, and Main and Service Laying.

Applications, stating Age, Experience, present and previous Occupation, and accompanied by *copies* of not more than Three Recent Testimonials, to be addressed to the Chairman of the Gas and Water Committee, endorsed "Chief Assistant," and Delivered at my office not later than Twelve o'clock noon on Monday, the 31st of December, 1917.

Canvassing the members of the Council will be a Disqualification.

By order
L. HEWLETT,
Town Clerk.

Town Hall,
Barrow-in-Furness.

LIMERICK BOROUGH COUNCIL.
(GAS COMMITTEE.)

THE above Committee will, at their Meeting to be held on Tuesday, Jan. 15, 1918, consider Applications for the Position of GAS ENGINEER and MANAGER of WORKS, at a Salary of £300 per Annum.

Candidates must be possessed of Practical and Technical Knowledge of all the Details connected with Gas Manufacture, Residuals, &c., Drawing up of Plans and Specifications for New Plant when needed, and generally to advise the Committee on the most up-to-date and economic principles of Gas Production.

Applications, stating Age, Experience, and Qualifications, to be accompanied with *copies* of Testimonials and Birth Certificate, to be addressed to the Chairman, Gas Committee, 34/35 William Street, Limerick, on or before the 14th of January, 1918.

By order,
M. FITZGERALD,
Secretary.

Gas Office,
Limerick, Dec. 11, 1917.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY.
(ASH ROAD GAS-WORKS, ALDERSHOT.)

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Applications to the Manager, MR. RITCHIE.
By order,
W. FISH,
Secretary.

CORPORATION OF CALCUTTA.
NOTICE TO CONTRACTORS.
LIGHTING STORES FOR THE YEAR 1918-19.

TENDERS are invited, in duplicate, for the Supply of LIGHTING STORES for Public Street Lamps and Municipal Institutions for Twelve Months from 1st of April, 1918.

Complete Specification and Descriptive List of Stores required, together with Tender Form, in duplicate, may be obtained from the Central Record-Keeper, Central Municipal Office Buildings, Calcutta, on payment of Rs. 2 only.

The following is a brief summary of the Principal Articles required:—
(a) Inverted Incandescent GAS-MANTLES for Street Lighting.
(b) Inverted Incandescent GAS-BURNERS complete
(c) GLASS CYLINDERS for Inverted Burners.
(d) GLASS PANES for Street Lamps.
(e) MAGNESIA NOZZLES for Inverted Burners.
(f) INVERTED INCANDESCENT GAS ARC LAMPS.

Samples are required where stated in the List, and these must be addressed to the Lighting Superintendent to the Corporation, 33 & 34, Wellington Street, Calcutta, carriage paid.

Tenders must include Delivery Free of all Charges at the Corporation Stores, Calcutta, including Duty and Insurance against Breakages. War Risk Insurance and extra Freight Charges (if any) to be separately stated.

The Corporation do not bind themselves to accept the lowest or any Tender, and will be at liberty to accept the whole or part of a Tender.

Tenderers may quote for any or all of the items mentioned in the list.

Payment will be made when Delivery is accepted.

Tenders must be addressed to, and will be received by, the Deputy-Chairman of the Corporation, up to 2 p.m. on Monday, the 4th of March, 1918, when they will be opened in the presence of such Tenderers as may be present. Each Tender, in Duplicate, must be enclosed in a Sealed Cover, and superscribed "Tender for Lighting Stores."

No Tender will be considered unless accompanied by a remittance to the extent of 2½ p.ct. on the total value of such Tender.

Tenderers must abide by the rules in regard to Tenders in vogue in the Corporation, and are required to submit Tenders in Duplicate on the Corporation Form above referred to.

C. C. CHATTERJEE,
Secretary to the Corporation.

Municipal Office,
Nov. 12, 1917.

WANTED—a Second-Hand Scrubber to pass about 1½ Million cubic feet per day. London district.
Particulars, with Price, to No. 6395, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

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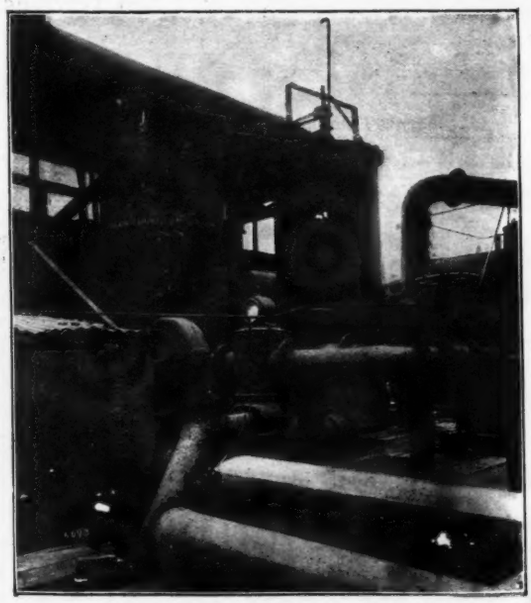

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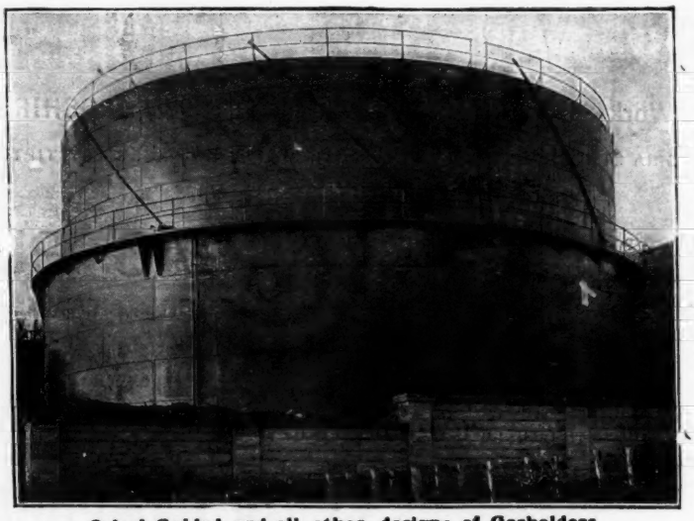

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Some of the tubes that were jointed with your "Permac," and through which steam at a temperature of 1000 degrees Fahr. has been passing for a considerable time, still show no signs of leak.
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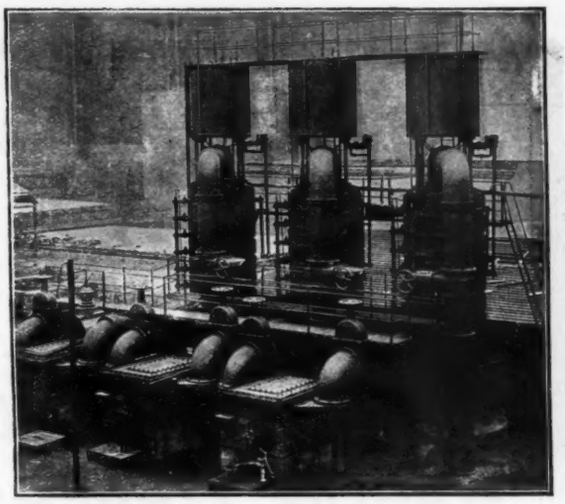

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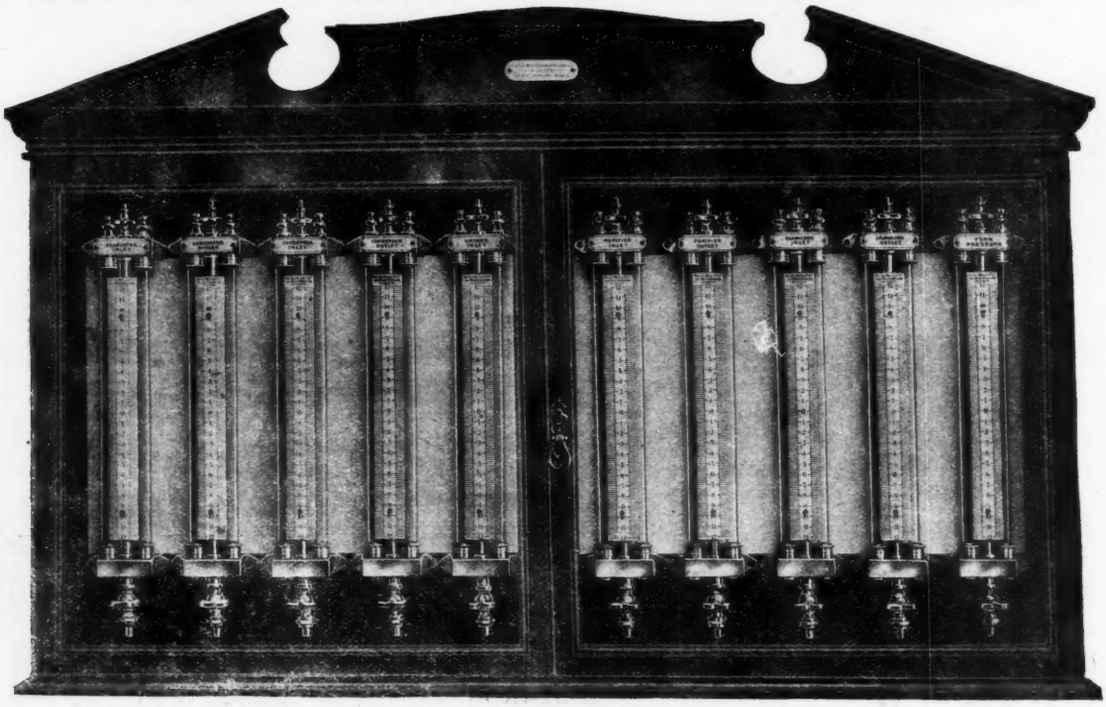

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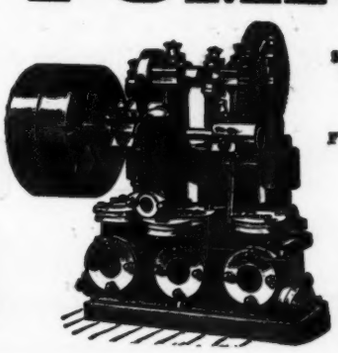

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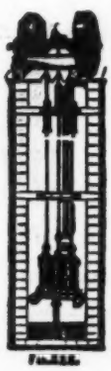

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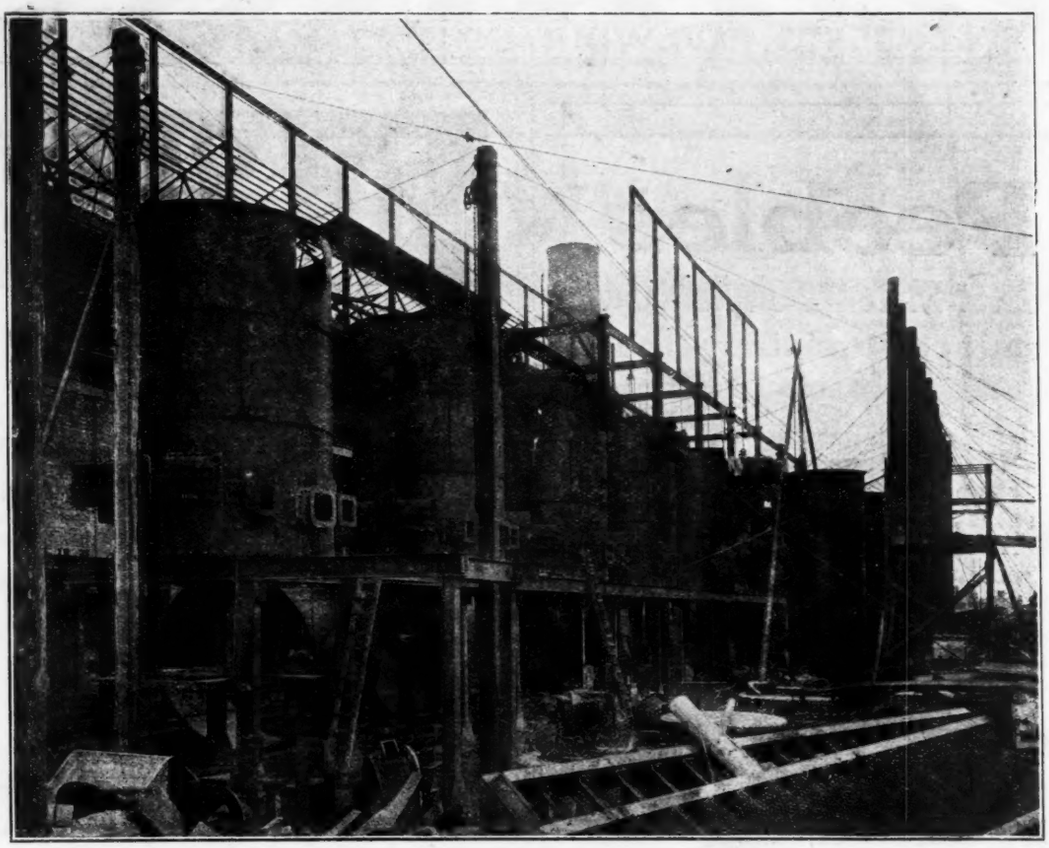

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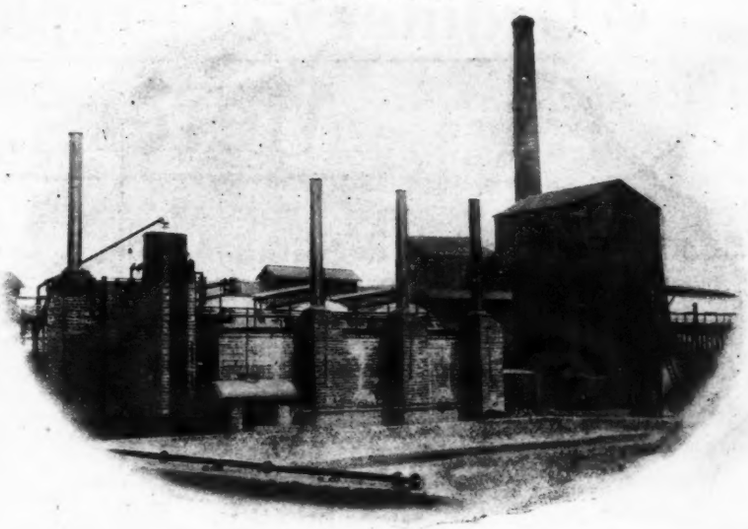

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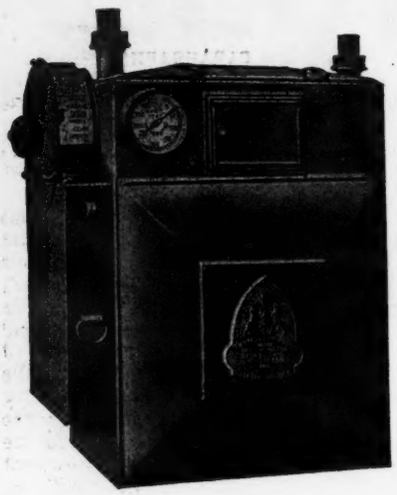

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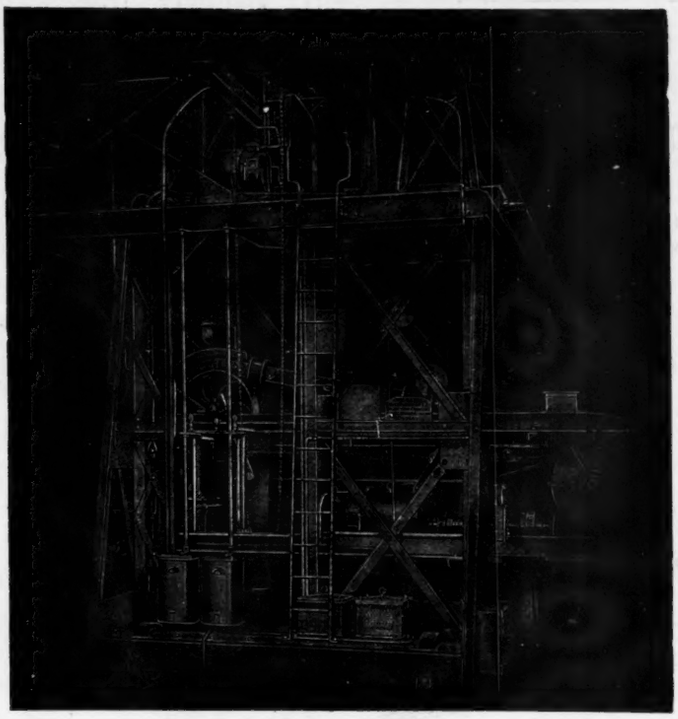

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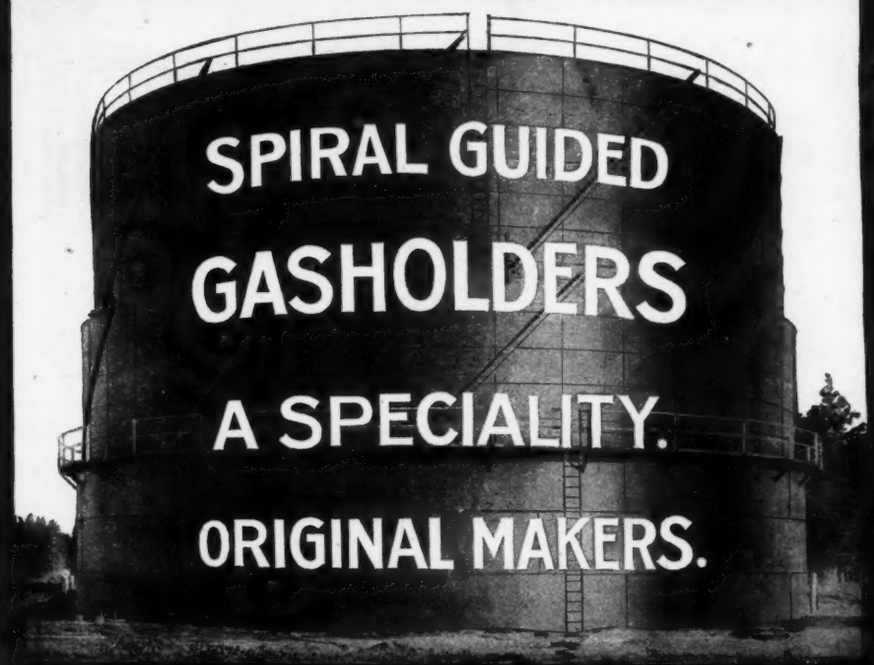

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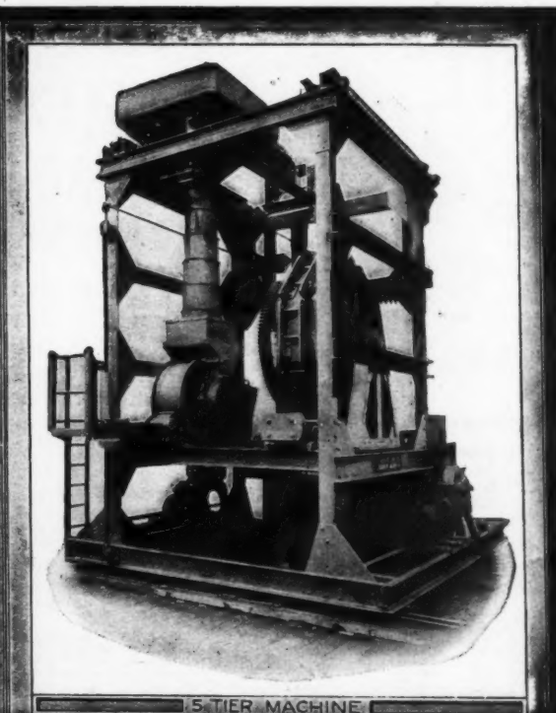

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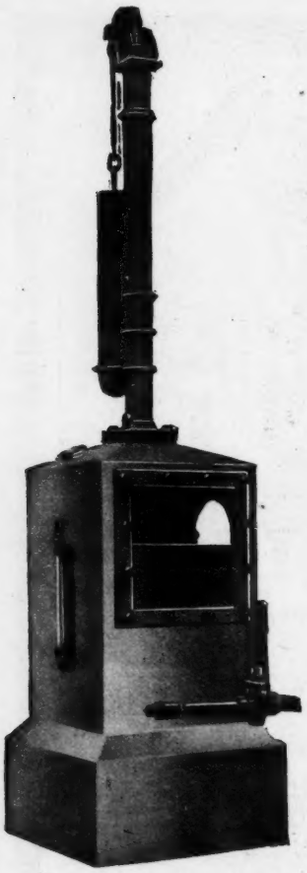

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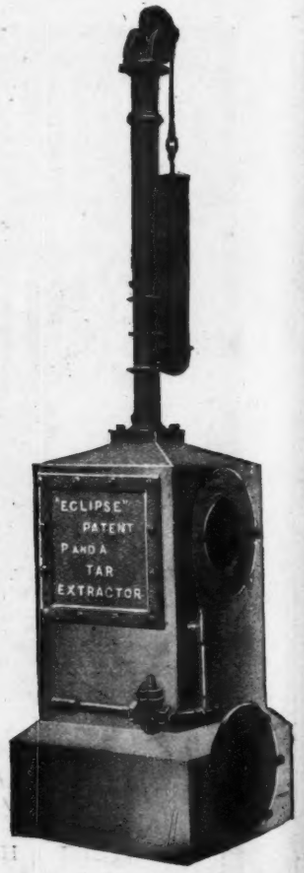

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